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OUR WORLD
A HUMAN GEOGRAPHY

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OUR WORLD
A HUMAN GEOGRAPHY

FOR USE IN SCHOOLS AND COLLEGES
IN INDIA, BURMA AND CEYLON

With New & Specially Prepared Maps & Illustrations

GOG 483

BY

CAMERON MORRISON, LL.B.

AUTHOR OF "A NEW GEOGRAPHY OF THE INDIAN EMPIRE AND CEYLON," ETC., ETC.
FOR TWENTY YEARS EXAMINER IN GEOGRAPHY IN THE UNIVERSITY OF MADRAS

WITH A FOREWORD
BY
SIR P. RAJAGOPALA CHARI
DIWAN BAHADAR, M.A., B.L., K.C.S.I., C.I.E.
MEMBER OF THE COUNCIL OF INDIA

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FOREWORD

I HAVE great pleasure in writing a few words to introduce Mr. Morrison's *Our World: A Human Geography.* I have read the book through with some care and find it fascinating to a degree. The author has had long experience of Indian conditions; he was for two decades the head of an important educational institution in Madras which under his wise guidance did sound work; he was Examiner in the Madras University during almost the whole of that period; he has travelled extensively in India, Burma and Ceylon; and he is intimately acquainted with the mentality of Indian boys. And he has produced a book on Geography which will be found to be an essentially human document and where what is known as 'Political Geography' is relegated—and rightly relegated—to a subordinate position. I have no hesitation in commending the book for use in the schools of India, Burma and Ceylon.

P. RAJAGOPALA CHARI,
Member of the Council of the Secretary of State for India.

THE INDIA OFFICE,
WHITEHALL, S.W. 1,
6th June 1925.

PREFACE

THIS book embodies an attempt to place the main features of World Geography before pupils and students in India, Burma and Ceylon. As it is, so far as I am aware, the first of its kind, it may perhaps be permissible to set down the main objects kept in view in its preparation.

In the first place, I have sought throughout to emphasise the human side of Geography; to regard the Earth as the Dwelling-place of Man, his Field and his Workshop; and to tell the story of how in varied climes and far-sundered lands he uses and modifies to his needs the physical features and resources of the world in which he is placed.

Secondly, the subject is treated expressly from the standpoint of the learners to whom it speaks. It is not just one more English class-book 'adapted' for their use. My Indian experience as a teacher, examiner, and writer in geography and as one who has visited almost every quarter of India, Burma and Ceylon has, I trust, enabled me to invest it with an appropriate atmosphere. It is not a treatise at large—much less a gazetteer—but a school-book written for youths such as those with whose daily lives and mental outlook I was for many years familiar. I have accordingly endeavoured to give it an Eastern setting and a perspective of its own; to adjust the focus for the learner and to look at things through his eyes; to work outwards from the near and familiar to the distant and strange and, at every step in the study of a foreign clime or people, to compare and contrast it with his own. No one knows better than the teacher that the main difficulty in geo-

graphy classes is how best to present the subject and no one more fully appreciates how exacting is this task than the writer of a text-book. Nothing is easier than to transcribe and record mere facts; nothing harder than to stimulate thought and impart ordered knowledge. I have made no attempt to go over the globe with a microscope or call out names from a map of the world. More has been cut out than left in.

At the same time I am a firm believer in repetition and I have, therefore, had no compunction in reiterating, from as many angles as possible, the essentials of the subject. As some help towards this, the narrative form has been largely adopted, and it has been my aim to convey a sense of movement in the story—we do not, for example, get to Africa or Europe by turning over a page, but on board a steamer from Bombay, Colombo or Rangoon.

Lastly, I would have the book judged by the answer to the question, Does it awaken interest? A dull task-book on such an eminently human theme as geography can scarcely hope to be educative.

I have been fortunate in having had various parts of the book revised by friends who have lived and travelled in the countries there described. For example, the earlier chapters and those on climate had the rare advantage of being revised by Mr. R. Ll. Jones, who was for many years Meteorological Observer with the Government of Madras. Mr. B. C. Wallis, B.Sc., the author of several standard geographical works, was kind enough to go over large portions and to him I am indebted for many valuable suggestions. Parts of the sections on the heavenly bodies are closely based on the Primer of Astronomy by Sir Norman Lockyer. The chapters on Canada owe many suggestions to a Director of the Canadian Pacific Railway. The book as a whole has been revised by Mr. M. J. C. Meiklejohn, B.A., F.R.G.S., who has also prepared the Index. For the chapters on India, Burma and Ceylon I have drawn freely on my earlier books dealing with these countries.

I trust the series of maps which have been specially prepared for the book may prove a real help to teacher and learner alike. They contain all—and more than all—the place-names which need be known by the pupils for whom it is written.

C. M.

University of St. Andrews,
July 1925.

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The Select Atlas of coloured maps is placed at the beginning of the book. Orographical, Political and Railway Maps, Diagrams and Illustrations dealing with particular areas will be found in the Chapters treating of the latter.

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ALL AND WINDS

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A R C T I C
ATLANTIC
OCEAN
Novaya
Zemlya
E U R O P E
Petrograd
(Leningrad)
Tobolsk
S
Orenburg
R. Ural
K I R G H I Z
L. Balkhash
Sea of
Aral
Black Sea
Constantinople
Smyrna
TURKEY
Angora
Batum
Tiflis
Caspian Sea
Baku
Mediterranean Sea
T U R K I S T A N
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Bukhara
Samarqand
Tashkent
Kashgar
Cairo
Suez
Canal
R. Nile
Aleppo
SYRIA
Damascus
Jerusalem
R. Euphrates
R. Tigris
Tabriz
Baghdad
Tehran
P E R S I A
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AFGHANISTAN
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Bushire
Persian Gulf
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Kalat
BALUCHISTAN
R. Indus
Delhi
A F R I C A
Medina
Jidda
Mecca
A R A B I A
Red Sea
OMAN
Muscat
Karachi
Allahabad
Berber
Khartoum
I N
Mocha
Bab el Mandeb
Aden
Perim
Arabian
Sea
Bombay
Hyderabad
Socotra
I N D I A N
Goa
Port.
Mangalore
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Calicut
Cochin
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Colombo
Maldive Is
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names

110 120 130 140 150 160 170 180
Bering Str.
O C E A N
Arctic Circle
Bering Sea
Kamchatka
Petropavlovsk
R. Lena
Yakutsk
S I B E R I A
Okhotsk
Sea of Okhotsk
Sakhalin (Karafuto)
FAR EASTERN REGION
R. Amur
Krasnoyarsk
Lake Baikal
Chitu
Irkutsk
Kyakhta
MANCHURIA
Harbin
Vladivostok
Urga
MONGOLIA
INNER MONGOLIA
Moukden
Sea of Japan
HONSHU
Tokyo
Yokohama
Osaka
Kobe
KOREA
Seoul
Wei-hai-Wei
Peking
Tientsin
Yellow Sea
Kyushu
Nagasaki
Hwang-ho
Nanking
Shanghai
CHINA
Hankow
Hanyang
Wuchang
Yang-tze-kiang
TIBET
Lhasa
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Formosa
JAPAN
PACIFIC OCEAN
R. Brahmaputra
BHUTAN
Yunnan
Canton
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BURMA
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Luzon I.
PHILIPPINE ISLANDS
Manila
Akyab
Irrawaddy
Hue
Bay of Bengal
Rangoon
SIAM
Bangkok
Mekong
FR. INDO-CHINA
Annam
South China Sea
Saigon
OCEAN
Malay Pen.
Penang
BORNEO
Sumatra
Singapore
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AFRICA, Place names

CAMEROONS
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FRENCH EQUATORIAL
Equator
Congo
L. Albert
UGANDA
KENYA
ITALIAN
Kismayu
L. Victoria
Nairobi
BELGIAN CONGO
INDIAN
Mombasa
TANGANYIKA
Lake
Tanganyika
TERRITORY
Zanzibar
Dar es Salaam
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SOUTH
Leopoldville
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Ascension
Loanda
ATLANTIC
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NORTHERN RHODESIA
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RHODESIA
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SOUTH WEST
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AFRICA
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Tropic of Capricorn
BECHUANA
LAND
TRANSVAAL
Pretoria
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Swazi Ld
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Orange
ORANGE FREE STATE
NATAL
Pietermaritzburg
Bloemfontein
Basuto Ld
UNION OF S. AFRICA
Durban
CAPE OF GOOD HOPE
East London
Cape Town
Simon's Town
Port Elizabeth
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Longitude East 20 of Greenwich
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CHAPTER I.

INTRODUCTION.

The Earth is the Home of Man. Geography is the Science or Śāstra of the Earth. When we learn geography, we study what kind of a home the earth is; its land and its water, where the mountains are and where the valleys and plains; how the winds blow and carry rain-clouds from one place to another; the hot parts and the cold parts; where the dry deserts are found and the damp places full of springs and rivers and marshes; what plants grow in different places; what animals live in them, and many other things. But a science teaches us the reasons of things. Therefore, in the science of geography we learn how mountains and plains have been formed and sea-coasts and islands; why some parts of our world are hot and why other parts are cool, and why some are covered with snow and ice; why winds blow in one direction and not in another; why some winds bring rain or heat and others are dry and cold; why in some parts there are dense forests or fertile plains, and why in other parts very few plants can grow, and the reasons for many other things we see on the earth.

Now, if no one lived on the earth, it would not be very interesting to learn these things. But the earth is man's home, and that is why it is interesting and useful to study geography. Geography is not only a science; it is also a story. It is a story telling us how man has made the earth his home; how he has used the land and the sea, the rivers and the plains and the sea-coasts; what plants he has learned to grow, what animals he has learned to tame; the canals and

anicuts, and tanks and wells he has made, and the minerals he has dug up from the earth ; what towns and harbours he has built, and how he has divided the world into different countries. Geography is thus the story of how man has made the earth his dwelling-place.

But, though the earth is man's world, it is not all the world. It is only a small part of a much larger world. When we look outside of our own earth we see the sun and moon and stars, and we know that these are other worlds—thousands of them. Tnerefore, when in the geography class, we study our own world, we must first learn something about these other worlds, so that we may find out, if we can, what part of them our earth is, and where it is. This is very difficult, but men have studied these things for thousands of years, and now we know something about them. So we begin by learning what men have found out about the place of our earth among the other worlds.

The Earth is a Heavenly Body.—This means it has a place in a great and boundless ocean. This ocean is not a water-ocean but an ocean of space. The part of this ocean, which we see, we call the sky or the heavens. The body which looks brightest in the sky is the sun, and the sun is a star. Our earth and some seven other bodies make up a family or group round the sun, and the sun and this group round it are called the solar system, because the sun (the Latin name for which is *sol*) is the master and centre of the others. It gives them light and heat, and makes them move in circles round it. Now, our earth and these seven other bodies (called planets) take up only a small corner of the boundless space which we call the heavens. But far, far away,—so far that our minds cannot imagine the distance—we see numberless stars scattered about. With our naked eye we can count hundreds of them ; with the help of telescopes we can count thousands. But how many stars are there beyond them that we cannot see ? No one can tell. Yet, even the nearest of these stars is many thousand times farther away from us than the sun is. They do not move round the sun. They are far outside our solar system. Perhaps they have each a system

of its own, made up of bodies to which they give light and heat, as the sun gives to us.

The Shape of the Earth.—Like the other planets, our earth is a globe.* This has been proved in many ways. Here are

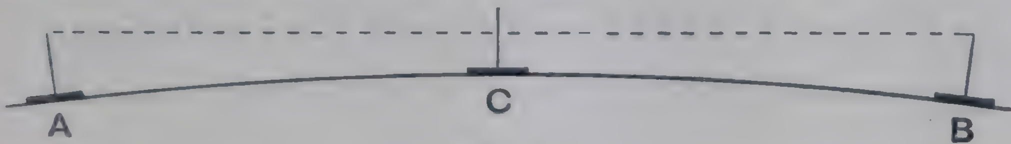

FIG. 1.

some of the proofs. Suppose we have three rafts floating on a long still stretch of water, say a canal or a lagoon. Each raft is fitted with an upright pole, fifteen feet in height. Place two rafts, *A* and *B*, at a distance apart of six miles with the third raft *C* midway between them. Then, if an observer looks through a telescope from the top of *A*'s mast at the top of *B*'s mast, he will find that the line of sight passes six feet below the top of *C*'s mast. As the water is smooth and level and the masts of the same height, this means that the water where *C* is floating is on a curve. Therefore, the line joining the tops of the three masts is curved. The surface of the water, *i.e.* of a level part of the earth, is curved.

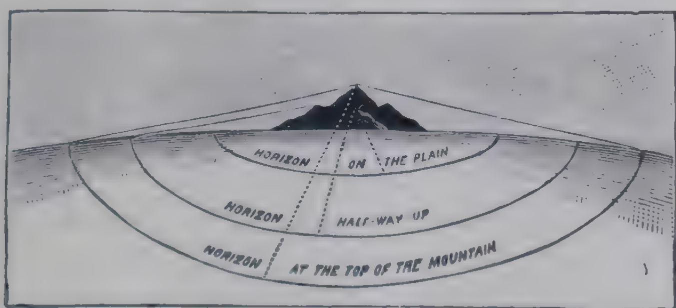

FIG. 2.

Again, everyone, who has made a voyage on the open sea, out of sight of land, has noticed that the area of vision is bounded by a curved line; the horizon is a circle. This happens wherever we are on the open sea. Wherever we may be, we are in the centre of a circle of ocean. If we climb the mast, the circle

* *Note to Teachers.*—The geoid form of the earth and its explanation may be deferred till the pupil has mastered the essentials.

is larger, but it is still a circle. This can only be the case if the surface of the earth is curved. The earth is a globe.

Any one watching a ship sailing out to sea notices that, bit by bit, the hull is lost sight of and the ship seems to sink beneath the horizon, the masts disappearing last of all. The ship seems to sink over a curve. When a ship is coming towards the shore, first the tops of her masts are seen and slowly the whole vessel comes into full view. She seems to climb

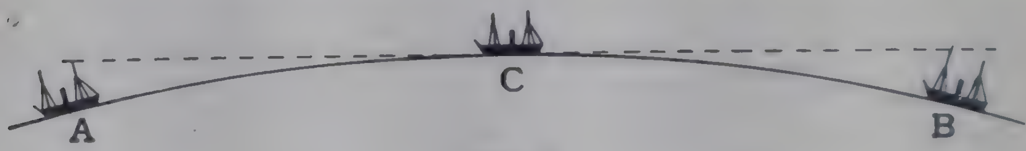

FIG. 3.

over a curve. If two ships sail in opposite directions, each seems to the other to sink beneath the horizon very quickly, because one is going down one slope and the other down another. If the earth were flat, no part of the ship would disappear sooner than another. The higher up a mountain we climb, the farther we can see over the plains. This would not happen if the earth were flat (Fig. 2).

Again, when the earth comes between the sun and the moon in an eclipse of the moon, the shadow of the earth is thrown on the moon's face. The boundary of this shadow is always part of a circle. A flat coin can throw a circular shadow if held in one position; the only body that can throw a circular shadow always, in any position, is a globe. Besides, all the other heavenly bodies, the sun, moon, and planets, are spherical in outline, from whatever point of view they are observed. Why, then, not the earth? Lastly, if we assume the earth to be a globe, we can explain a hundred things about it; if we do not, we can explain nothing. The earth is a globe in space.

The Size of the Earth.—Geometry teaches us that if we know the length of a small part of a circle, we can tell how large the whole circle is. More than 2000 years ago a Greek in Egypt (even then the Greeks believed the earth was a globe) calculated the size of the earth. Instead of making his experiment, we could make one like it ourselves. On July 29th the sun is

straight overhead at Bombay. On the same day at Ahmedabad, 345 miles north of Bombay, he shines at an angle of 85 degrees.

Representing this by a diagram :—$XBAY$ is the curved surface of the earth : B is Bombay and A is Ahmedabad. SB is the direction of the rays of the sun striking Bombay ; this line produced passes through C the centre of the earth. AC is the line joining Ahmedabad with the centre of the

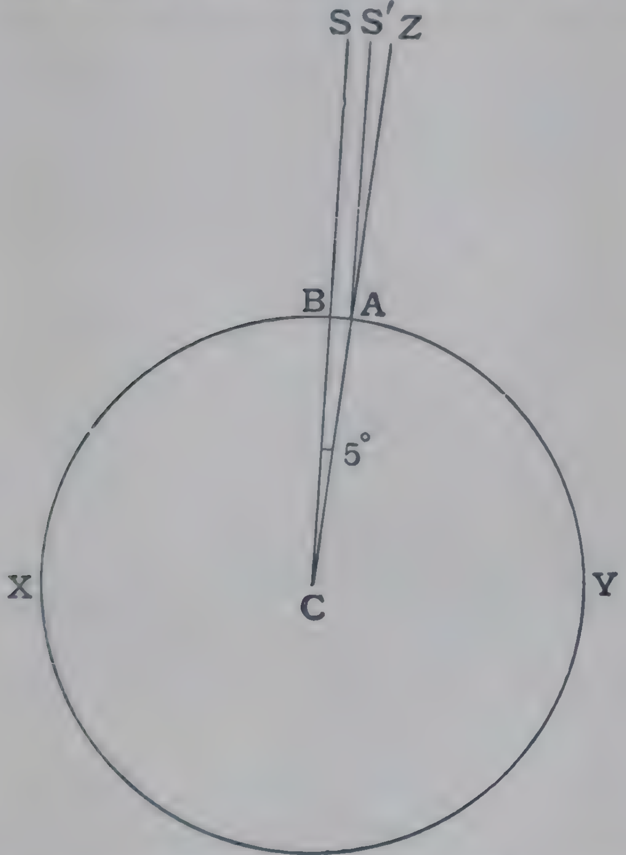

FIG. 4.—How the circumference of the earth is measured.

earth. When the sun is overhead at B, his rays, being all parallel, strike A in the line $S'A$ and this line makes an angle with the zenith at A of 5°. Since SBC and $S'A$ are parallel, the angle $S'AZ$ = angle $SCA = 5°$;

∴ the arc BA of 345 miles subtends an angle at centre C of 5° ;

∴ an angle of 1° will be subtended by an arc of $\frac{345}{5} = 69$ miles,

and since the whole circle comprises 360°

the circle $= \frac{345}{5} \times 360$ miles $= 24840$ miles (roughly).

Hence we can take the circumference of earth = 24800 miles;

$$\therefore \text{ Diameter of earth} = \frac{\text{circumf.}}{\pi}$$

$$= 24800 \times \frac{7}{22} = 8000 \text{ miles (roughly)};$$

$$\therefore \text{ radius of earth} = 4000 \text{ miles.}$$

$$\text{Area of surface of globe} = 4\pi r^2 \text{ sq. miles}$$

$$= 4 \times 3\tfrac{1}{7} \times (4000)^2 \text{ sq. miles}$$

$$= 200 \text{ million sq. miles (roughly).}$$

The Earth Rotates. *Day and Night.*—The sun rises from one part in the horizon, which we call the east, and sets in another, which we call the west. At night the stars on the eastern horizon rise higher and higher, and those in the west sink lower and disappear. They do not move among themselves but keep their places, following one another regularly across the sky, in a path which is part of a circle. The moon does the same. We see the same stars to-night as we did last night, and the same moon. This means, either that our earth is at rest and the sun and stars travel round it, or, that the earth itself is turning round and the sun and stars are at rest. Long ago people thought the earth was at rest, and that the sun and stars travelled round it. Even to-day we say 'the sun rises and sets.' But now everyone is agreed that it is really the earth which moves.

As men studied the sun and stars, they found out: (1) that the sun is at an enormous distance (93,000,000 miles) from the earth; (2) the sun is very large, his diameter being 108 times that of the earth; (3) when one body moves round another, as the satellites move, each round its own planet, it is always the smaller body which moves round the larger, and never the larger round the smaller. If the sun really moved round the earth in a circle, this circle would be $2 \times \frac{22}{7} \times 93$ million miles and he would move round this circle in twenty-four hours, *i.e.* he would move at a rate of over twenty-four million miles per hour, or faster than light itself, which is absurd.

It is now known for certain that the movement of the stars and the sun, across the sky, is not real but only apparent (just

as, when we are in a fast train, the fields and trees seem to rush past), but that really it is the earth that turns round. When we say the sun is rising, we really mean that the part of the earth where we are has just rolled into the light of the sun; at mid-day it has rolled round so far as to come into the full light of the sun: at sunset, it is just rolling out of the sun's light. When we say the sun moves across the sky from east to west, we really mean the earth is turning round in a west to east direction. It is the same when we say the stars rise or set. The sun or moon, or any star can shine only on one half of the earth at any moment. One half is lighted up by the sun and there it is day; the other half is not lighted up and there it is night. But, as the earth rotates, each part of it in turn comes into the light of the sun or moon or star. The sun is always rising on some places on the earth and, at the same moment, setting on others, exactly half way round the globe. If a telegram leaves Bombay exactly at sunrise and gets to Calcutta in a few seconds, it arrives when the sun at Calcutta has been above the horizon for over an hour.

The fixed points and circles in a rotating globe. Our earth rotates steadily always in the same direction.—If it did not, we could never tell where or when the sun would rise or set. It might pop up or sink out of sight at any time or place. Now, when a globe, instead of turning about now this way now that, always turns in precisely the same way, it is said to turn on the same axis. The axis is an imaginary line passing through the globe. The axis does not change. The ends of the axis are called poles (a Greek word meaning turning-places). As the globe rotates, every point on its surface describes a circle round the axis. A point on the surface, midway between the poles, makes the largest circle. This circle, drawn round the globe, half-way between the two poles, is called the equator or dividing line. The circles described by all other points are smaller than this circle, but are parallel to it. We can draw only one equator but we can draw any number of circles parallel to it. On every school globe the poles and parallel circles are marked. One pole is called the north, the other

the south pole. How many circles parallel to the equator, are marked on your globe? These circles are called parallels of latitude. They are used to show how far any point on the surface of the globe is distant from the equator, either on one side of it or on the other.

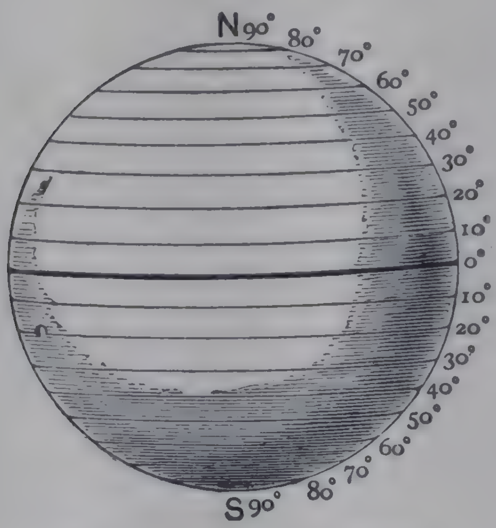

FIG. 5.—Parallels of latitude.

But there are other quite different lines marked on the globe. These lines are drawn over the surface of the globe, joining the two poles and cutting the equator. As they lie on a curved surface, they are, of course, half circles. Each half circle is matched by a corresponding half circle, exactly on the opposite side of the globe, which also cuts the equator. We can draw any number of these half circles. How many are marked on your globe? They are not parallel to each other for they all meet at the poles. They are called Meridians of Longitude. They are used as measuring lines to show how far round the globe one point is from another, east or west.

Meridian is a Latin word meaning mid-day. A Meridian is a line joining places which have their noon at the same time. Thus Jubbulpore and Colombo are on the 80° E. meridian. Their noon is the same and so is their midnight, and their clocks keep the same time. All places on the same meridian are due north or south of one another.

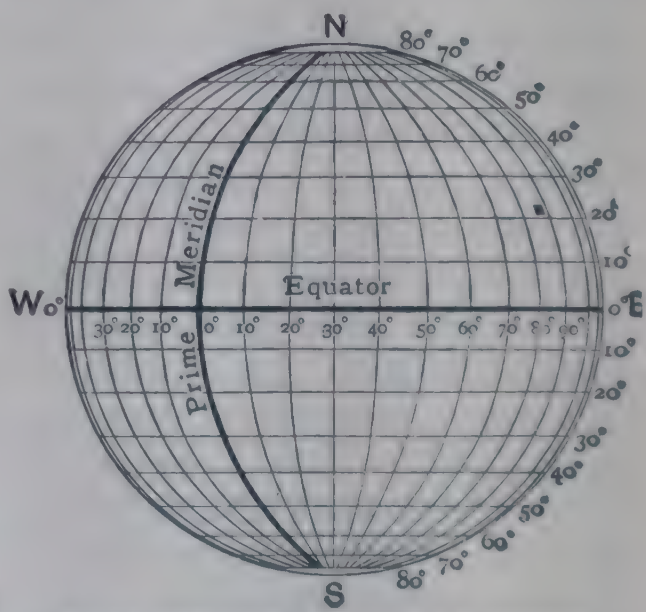

FIG. 6.—Parallels of latitude and meridians.

Every line joining two points on the surface of a globe, must be a part of a circle. When we measure a circle, or part of one, we can either measure *along* it, and say it is an inch or a yard, or a mile, or a thousand miles in length, or, we can say it is so far *round* the circle, say 10 degrees round, or 50 or 75. If we go right round a circle, we go round 360 degrees; if we go half round it, we pass through 180 degrees and so on. On a school globe measurements are made in this way. If a parallel of latitude is marked 10°, this means it is drawn through all points 10 degrees from the equator, either to one side or the other. If it is drawn on the side nearer the north pole, it is called the 10 degree parallel of North Latitude (10° N.). If on the other side, we call it the parallel of 10 degrees South Latitude (10° S.), and so on for the other parallels of latitude.

The meridians of longitude are also marked by degrees. What are the degrees marked on the meridians of your globe? Turn it round and you will find one meridian marked 0°. Trace this line from pole to pole. It cuts the equator on the part of the globe which shows the Atlantic Ocean. It also passes through a part of London called Greenwich, where stands a large observatory, and it is, therefore, called the Meridian of Greenwich, or the Prime Meridian. The other half circle, corresponding to this on the opposite side of the globe, is marked 180°, because it is exactly half-way round the circle of the earth from the meridian marked 0°. The Greenwich Meridian is the most important, because all others are measured from it, either to east or west. Thus the meridians marked 15° E., 45° E., 90° E., are those which pass through points marked 15° E., 45° E., and 90° E., measured along the equator, eastwards from the point marked 0° on the equator. And, in the same way, meridians marked 15° W., 45° W., and 90° W. pass through points measured westwards along the equator from the same point.

These lines are useful because they help us to tell whereabouts on the globe any place is—how far it is north or south of the equator, *i.e.* its latitude, and how far it lies east or west of the Meridian of Greenwich, *i.e.* its longitude. A degree

is divided into sixty minutes. Thus Bombay is in 18° 55′ North Latitude, and 72° 54′ East Longitude, *i.e.* it is 18 degrees and 55 minutes north of the equator and 72 degrees and 54 minutes east of the Meridian of Greenwich. Calcutta is 22° 30′ N., 88° 30′ E.; Poona is in 18° 30′ N., 74° E.; Karachi is in 24° 50′ N., 66° 53′ E.*

Rotation and Time—Greenwich Time and Indian Standard Time.—But the earth is not only a globe, but a globe steadily rotating on its axis once every twenty-four hours. This means that the earth turns through 360 degrees in twenty-four hours. Therefore, in one hour it turns through $\frac{360}{24}$ degrees or through 15 degrees. If a point *A* on the earth is exactly 15 degrees due east of *B*, then *B* rolls round to exactly the same place as *A* was one hour previously. If the sun rises at *A* exactly at 6 o'clock, it rises at *B* exactly one hour later. If, at *A*, the sun is at his highest point in the sky at 12 o'clock, one hour must pass before the sun is at his highest at *B*. Mangalore, on the Malabar coast, is in Longitude 75° E. of Greenwich. Therefore, it is noon at Mangalore exactly $\frac{75}{15}$ hours = 5 hours before it is noon at Greenwich, or at any place on meridian 0°. Calcutta is in $88\frac{1}{2}$° E. Longitude. Therefore, it is noon in Calcutta nearly six hours before it is noon at Greenwich. It is sunrise in Calcutta when it is about midnight in England. In India the sun is at its highest point at different times in different places. Calcutta is in $88\frac{1}{2}$° E. Karachi is in 67° E. This is a difference of $21\frac{1}{2}$ degrees or nearly an hour and a half. It is noon at Calcutta nearly $1\frac{1}{2}$ hours before it is noon at Karachi. Sun-time is different in the two places.

Every place has its own sun-time. If every place in India set its clocks by its own sun-time, *i.e.* if each place put the hands of its clocks to show 12 o'clock at the moment when the sun was at its highest point there, what would happen? We should have hundreds of different clock-times all over India. This would be most inconvenient. Rail-

* In new countries, such as the United States and Australia, meridians of longitude and parallels of latitude are used to mark the boundaries of states.

way time-tables would be confused. So, the Government of India has arranged to have one clock-time for the whole of India, and this is called Indian Standard Time. As the earth turns from west to east, the meridians of different places come under the sun's rays—first at, say, Chittagong, then at Dacca, then at Calcutta, then at Patna, Madras, Delhi, Sholapur, Poona, Bombay, Karachi—one after the other, farther and farther west. The sun-time of Chittagong is much earlier than that of most places in India, and the sun-time of Karachi is much later. So the meridian of a place somewhere between them was chosen. This is $82\frac{1}{2}$ E. When the sun is straight over the meridian of $82\frac{1}{2}$ E., it is noon there, and that moment is called 12 o'clock all over India. This Standard Time is kept on all the railways. But many Bombay clocks keep Bombay sun-time, which is of course, a little later than standard time. If a train is timed to leave Bombay at six o'clock, this means six o'clock railway and standard time, not Bombay local time. In the same way, when the sun passes over the meridian at Greenwich, the Observatory clock is set to show 12 o'clock, and this is the standard or Greenwich time in England and Scotland at that moment. This Observatory clock keeps the time for these countries. As England and Scotland are small countries, the sun-time of any place there cannot be very different from the standard time. Ireland has a standard time of its own, which is twenty minutes later than Greenwich time.

As the standard time in India is fixed by the $82\frac{1}{2}°$ E. meridian, it is just 5 hrs. 30 mins. fast on Greenwich time. In Burma the standard time is taken by the $97\frac{1}{2}°$ E. meridian so that it is just an hour before Indian standard time. If a ship is steering west, her clock is put back so much each day ; if she is steering east, her clock is put forward ; if she is steering due north or south it is not changed, because she remains on the same meridian.

How the Revolution of the Earth explains the movements of the Stars during the year.—We have now seen that the earth is a globe and that it spins or rotates steadily on its axis. But

the earth has another motion. It revolves through space in a nearly circular path round the sun. It is a planet. This can be proved by noticing that we do not, night after night, see just the same stars in the same places in the sky. The stars do not appear to move among themselves. They keep their places. But if we view the sky for many nights in succession at midnight, we find them gradually falling away to the west. There is a slight change in a few days. If we view the stars overhead at midnight at any time of the year, and again, at midnight, six months later, we see quite different stars. In six months there is a great change. After the lapse of a year we see the same stars in the same place, at midnight, as we saw them twelve months before. The stars have not really moved during this time. The earth has moved. For thousands of years people have observed these regular changes. They have called the time, during which these changes take place, a year.

To explain this, we have to make an experiment. In a dark room take an orange to represent the earth and a lamp to represent the sun. Stick a long needle through the orange and then into a piece of wood or a table to keep it steady. Suppose there are many pictures on the walls of the room. These represent the stars in the sky.

Now imagine the lamp at rest and the orange at rest. The part of the orange turned towards the lamp will always be lighted up, and the other half turned away from the lamp, will always be in the dark. Thus, if the earth were quite at rest, one half of it would have perpetual day and the other half would have perpetual night. People in the half turned towards the sun would always see the sun in the same place in the sky. To those in the centre of the lighted-up half the sun would appear straight overhead; to those near its edge he would appear near the horizon; to those just on the edge between the light and dark halves he would appear on the horizon. In the same way, to those people living on the dark half the sun would always be below the horizon: they would never see him. But, just as the dark half of the orange in the room

is turned towards the pictures on the wall opposite to it, so, to people on the dark half of the motionless earth, the same stars would always appear in the same place in the sky.

Next, stick a pin up to the head in the equator of the orange, to represent an observer on the earth, and turn the orange round on its needle, or axis, to represent the rotation of the earth. Whenever the pin's head is in the middle of the lighted-up half of the orange, the part exactly opposite is in the middle of the dark half. Half a turn of the orange brings the pin's head from the middle of the lighted-up half into the middle of the dark half. Thus, if the earth only rotated but did not move from its position, an observer on the earth would always see the sun at mid-day in the same place in the sky, and the same stars in the same place at mid-night: one set of stars at sunrise and another set at sunset.

But if we move the orange round the lamp in the same direction as the earth rotates, then, at different positions in this circle, the pin's head, when in the dark half, would be opposite different pictures: first opposite those on the first wall, then opposite those on the second, then opposite those on the third, then opposite those on the fourth, and at last it would be opposite those on the first wall once more. Every time the orange turns round (rotates), the pin's head will have a slightly different part of the wall opposite to it. Thus, as the earth rotates, our part of the earth is nightly turned away from the sun, and we see stars opposite us or 'above' us as we say. But, as the earth revolves round the sun, our part of the earth is brought opposite, or under, different sets (constellations) of stars, one after the other. Every night they change a little; gradually one set follows another: in six months they are completely different: after a year has passed, our part of the earth at mid-night is brought opposite (or under) the same stars as it was under twelve months before. Of course, there are stars all round us in space, just as there were pictures all round the room. But when our part of the world is lighted up by the sun, we cannot see them owing to his bright light. Sometimes, when the moon comes between

us and the sun, and his light is eclipsed or partly shut off, we can then see the stars in the sky round the sun. Just as the stars opposite, or over, the dark side of the earth change during the year, so do the stars opposite, or over, the lighted-up side.

The sun is much nearer to us than are the stars, just as the lamp was nearer the orange than the pictures behind it were. Therefore, when we see the sun, he is really in front of different stars, though we cannot see them. Certain sets, or constellations, of stars are behind him; one set after another as the year passes and the earth revolves. Just before dawn we can see, on the eastern horizon, the constellation just ahead of the sun. Just after sunset we can see in the west a constellation setting just after him. But month after month a new constellation rises just before him and a new one sets just after he does. The sun, therefore, appears to move in a path among the stars, just as, to the pin's head on the orange, the lamp appears to have different pictures behind it, one after the other, as the orange revolves round the lamp. In this way, if we know what stars are behind the sun on any date, we can tell what time of the year it is. If he rises just after a particular group, or constellation, of stars, we know it is January; if he rises just after another constellation, we know it is June and so on.

The Hindus, Greeks, Egyptians and Chinese long ago gave names to the sets of stars lying in the Sun's path. Their English names are the Ram, the Bull, the Crab, the Scorpion, etc. There are twelve of them, and the Sun takes a month to pass in front of each. What time of the year is it when the Ram is behind the Sun?

CHAPTER II.

PLANES OF ROTATION AND REVOLUTION.

We have now learned that the earth has two motions. It rotates steadily on its own axis once every twenty-four hours: it revolves steadily in an ellipse (very nearly a circle) once every $365\frac{1}{4}$ days. We say it rotates steadily, because its axis always points in the same direction: the north pole is always straight under the Pole Star and, if we could produce the axis through the north pole, this line would pass through the Pole Star, millions of miles away.

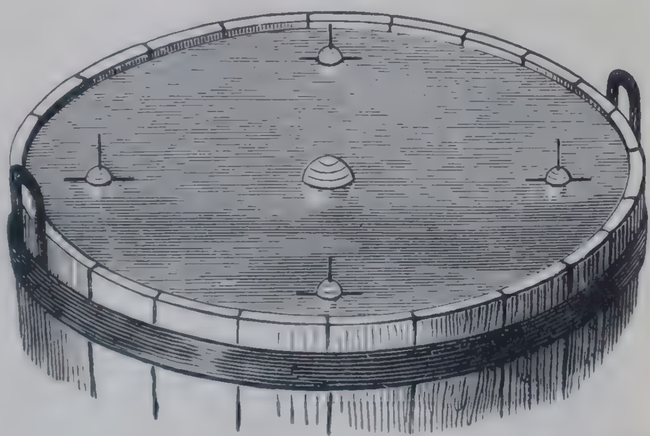

FIG. 7.—The level of the water shows the plane of the ecliptic.

The Plane of Rotation and the Plane of Revolution.—Imagine a large vessel of water, in the centre of which is one large globe floating up to its middle and another, smaller, globe also floating up to its middle and moving round the large one in a circle. Then the level, or plane, of the water is the level in which the smaller globe moves: it is the plane of its revolution. The smaller globe always floats half sunk in the water: it does not sometimes rise above the water and sometimes sink below it. As it revolves, it always keeps in the same plane. Now, this is what the earth does. It always keeps in the same plane as it revolves round the sun. This plane is called the Plane of the Ecliptic.

Now if, through the smaller ball, we stick a long needle, so that the needle stands upright at right angles to the level of the water, and then gently twist this needle round, what happens? The small globe will rotate with the needle as its axis. The globe will not wobble. The same half of it will always be wet and the same half dry. The globe will rotate on its axis, in the same plane as the water. That is, it will rotate in the same plane as its plane of revolution round the large globe. Now the earth does not do this: its plane of revolution round the sun is not the same as its plane of rotation on its axis.

Next, if, instead of floating with the needle upright, the ball is made to float with the ends of the needle just on the surface of the water, and if we twist the needle, the ball now rotates in a plane perpendicular to the level of the water. Its plane of rotation is perpendicular to the plane of the water, *i.e.* to its plane of revolution. Now, the earth does not do this: its plane of rotation on its axis is not perpendicular to its plane of revolution round the sun.

Once more, if the ball is made to float somewhere between these two positions, its plane of rotation will be at an angle to the plane of the water, *i.e.* to its plane of revolution. Now this is what happens in the case of the earth. It revolves round the sun in one plane steadily and smoothly: it rotates on its axis steadily and smoothly in another plane; and this plane is inclined to its plane of revolution at an angle of $23\frac{1}{2}$ degrees (Fig. 8).

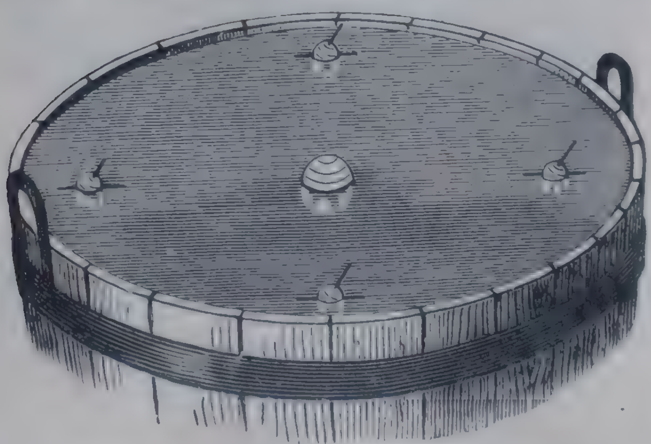

FIG. 8.—Showing how the axis of the earth is inclined to the plane of the ecliptic.

If we imagine the sun floating in an ocean and the smaller earth floating round it, then the axis of the earth is not pointing

straight up, but at an angle of 23½ degrees. At one point of its revolution round the sun, the earth would be in this position (position *A*). Here the plane, or level, of the water makes an

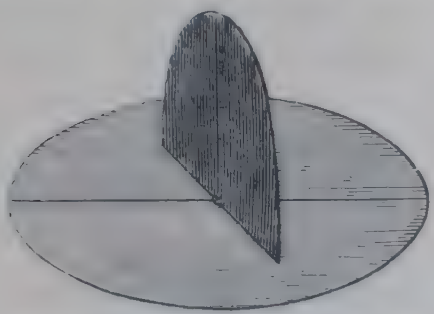

FIG. 9.—Two planes cutting each other at right angles.

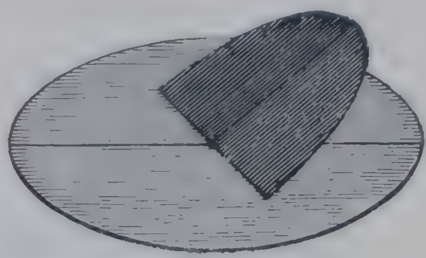

FIG. 10.—Two planes cutting each other obliquely.

angle of 23½ degrees with the plane of the equator and cuts the surface, or circle, of the earth at a point 23½ degrees north of the equator and 66½ degrees south of the north pole. When

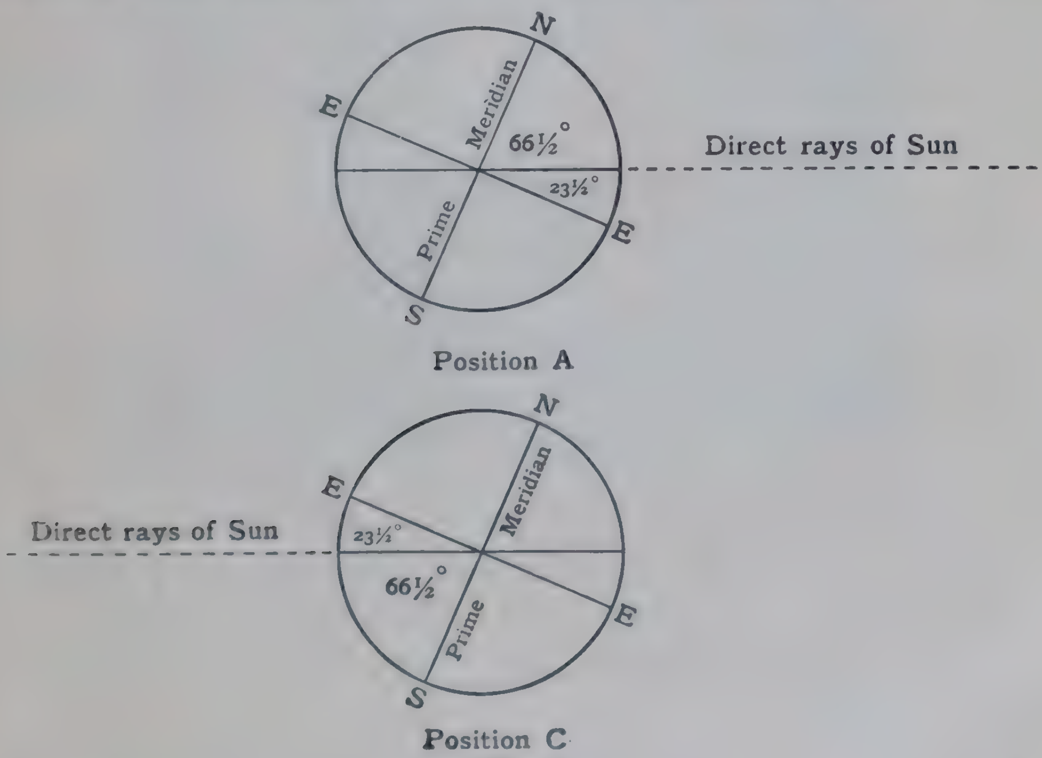

FIG. 11.

the earth has revolved half-way round the sun, on the other side of it (*i.e.* six months later) the position will be just the opposite (position *C*). Here, as before, the line joining the centre of the sun and the earth makes an angle of 23½ degrees

with the plane of the equator. But it now cuts the circle, or surface, of the earth at a point $23\frac{1}{2}$ degrees south of the equator and $66\frac{1}{2}$ degrees north of the south pole.

Now, what are the positions of the earth and sun, when the earth has left position *A* and has made a quarter of its revolution round the sun half-way to position *C*: also when, six months later, it has left position *C* and has reached a position half-way between *C* and *A*? We may call these two half-way positions, position *B* and position *D*.

When the earth is in either of these positions (*B* and *D*) the sun will be in the position of our eye, looking straight at the paper. Here, too, as before, the plane of revolution will make an angle of $23\frac{1}{2}$ degrees with the plane of rotation, *i.e.* the plane of the equator. But, in this case, the line joining our eye, the sun, with the centre of the earth will cut the circle, or surface, of the earth not north or south of the equator, but *at* the equator. As the earth rotates in this position, a point on the equator is straight between our eye (the sun) and the centre of the earth.

Of course, we know that the earth and the sun do not float in an ocean, but in space; but their positions are just as has been described.

Pictures to shew different positions of the Earth in its yearly revolution.—Here are four pictures of the earth as it would appear looked at from the sun in the four positions. Our eye, as it looks at the picture of the earth, is the sun. The white parts of the earth are land and the dark par s are water. Parallels of latitude and meridians of longitude are marked on the globe of the earth. The thick meridian is the prime meridian passing through Greenwich. The other thick line is the equator.

Fig. 12 shows the earth in position *A* on June 22nd. Our eye, the sun, is looking straight at the prime meridian—*i.e.* the sun is shining straight down on this meridian. It is therefore noon at Greenwich, and noon at all places on this meridian. Noon means the time of day when the sun is at its highest point in the sky. India, you see, has passed to the

east and it is evening there. We can just see, on the very edge of the map, where Calcutta is. Therefore, when it is noon at Greenwich, the sun at Calcutta appears on the edge of the earth, *i.e.* on the western horizon, and it is evening there. Now, in this position of the earth, where does the straight line joining our eye to the centre of the earth strike the surface of the earth? At a point on the prime meridian north of the equator —23½ degrees north of it. A map shows this point is in the

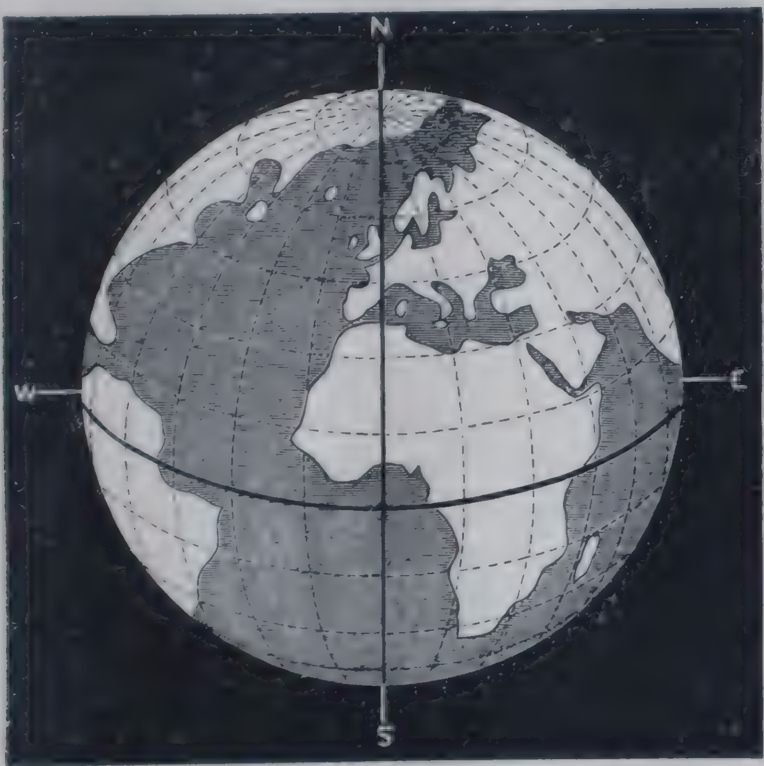

FIG. 12.—Position *A*. The earth as seen from the sun at the summer solstice, June 22. Noon at Greenwich.

broad shoulder of Africa, in the desert of Sahara. So, to a man living at that spot the sun at noon on June 22nd appears straight overhead, *i.e.* in the zenith. As the earth rotates, all people living just 23½ degrees north of the equator (*i.e.* on the Tropic of Cancer) will, one after another, see the sun in the zenith at noon. When the earth has rotated about three-quarters farther round, people at Dacca, Jubbulpore and Bhopal, one after the other, will see the sun in the zenith at noon (or very nearly in the zenith, because these towns are not exactly on the Tropic of Cancer).

On June 22nd the captain of a ship in the Gulf of Guinea, where the equator and the prime meridian meet, will see the sun at noon—where? Not overhead but $23\frac{1}{2}$ degrees north of the zenith. So, as the earth rotates, people on the equator will, one after another, see the sun at $23\frac{1}{2}$ degrees north of the zenith, *i.e.* $66\frac{1}{2}$ degrees up from the northern horizon on June 22nd. People at the north pole on June 22nd will see the sun at noon, not in the zenith, but $66\frac{1}{2}$ degrees south of the zenith, *i.e.* only $23\frac{1}{2}$ degrees up from the southern horizon.

In the same way, on June 22nd, in the southern hemisphere, people on the Tropic of Capricorn will see the sun at noon $23\frac{1}{2}° + 23\frac{1}{2}° = 47$ degrees north of the zenith, *i.e.* nearly half-way up the sky. If any one lived at the south pole, he would not, on June 22nd, see the sun because, as the picture shows, that part of the earth is turned away from the sun: our eye (the sun) cannot see it. As the earth rotates, the sun does not shine on the south pole on June 22nd. It is night for twenty-four hours. At noon on June 22nd, people living just on the southmost edge of the globe in the picture will see the sun just on the horizon. As the middle of the lighted-up globe is $23\frac{1}{2}$ degrees north, the southern edge of it must be just 90 degrees away, *i.e.* $66\frac{1}{2}$ degrees south of the equator. All people on the circle marked $66\frac{1}{2}$ degrees south of the equator, *i.e.* the Antarctic Circle, will, one after the other as the earth rotates, see the sun on their northern horizon at noon on June 22.

The Seasons.—We can thus understand that on June 22nd the sun shines more directly on the northern half of the earth than on the southern half. This means that he gives more light and heat to the one than to the other. On that day the hottest part of the earth's surface is the part near $23\frac{1}{2}°$ N. The Tropic of Cancer passes across India, and in June the heat there is great. June 22nd is the middle of summer in the northern hemisphere and the middle of winter in the southern hemisphere. But, as we go farther and farther from this tropic, either towards the north pole or the south pole, the

heat becomes less, because the sun shines from a lower and lower point in the sky.

But that is not all. On June 22nd the sun also shines longer on places north of the equator than on places south of it. Look at picture *A* again. As we go north from the equator, you see the circles marked parallel to the equator are more and more complete. We see only one half of the equator; of the next circle we see a little more than half; of the next still more; till, finally, we see the whole of the last circle marked. This is the Arctic Circle and it is 66½ degrees north of the equator. Think what this means. It means that, on June 22nd, the sun is shining on exactly one half of the equator: the other half is hidden from the sun: it is in darkness. As the earth rotates, people on the equator make a journey, half of which is in light and the other half in darkness. Day and night at the equator are equal. But, as we go north, the sun shines on more and more of each successive circle. As the earth rotates, people on these circles make a journey more than half of which is in light and less than half of which is in darkness. There day is longer than night. There the sun rises north of east and sets north of west. As we go north, the day becomes longer and the night shorter. As we go north, the sun rises farther and farther north of east, and sets farther and farther north of west. At last, when we come to the Arctic Circle, the sun is always above the horizon. There are then twenty-four hours of daylight on all places within the Arctic Circle. Just the opposite is the case in the southern hemisphere. On June 22nd, as we go south from the equator, the circles are less and less complete. More and more of them are hidden from the sun. This means that, as we go south from the equator (where night and day are equal), the nights are longer and longer and the days shorter and shorter. At last, when we reach as far south as 66½ degrees (the Antarctic Circle), the sun does not rise above the horizon and the night there is twenty-four hours long. All places within the Antarctic Circle have a night of twenty-four hours on June 22nd.

We can now tell two things about the climate of the world at midsummer (June 22nd).

1. The sun gives more light to the northern hemisphere than he does to the southern. The land round the south pole does not get any daylight then. He also gives more heat to the northern than to the southern hemisphere. Why? Because he shines more directly down on it.

2. The sun shines longer on places in the northern hemisphere than he does on corresponding places in the southern

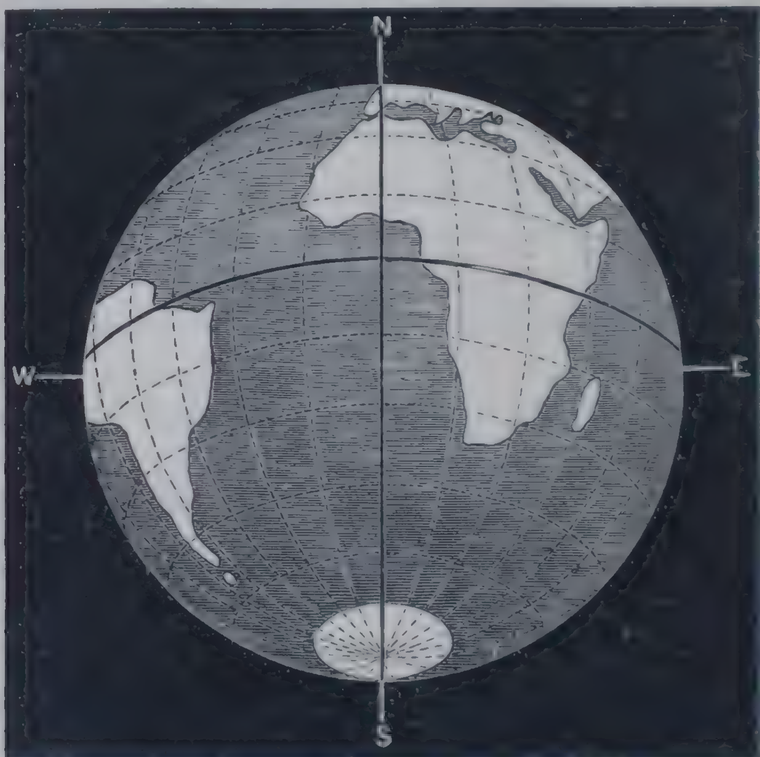

FIG. 13.—Position *C*. The earth as seen from the sun at the winter solstice, Dec. 22. Noon at Greenwich.

hemisphere. The day is longer in the former places than in the latter. It is, therefore, the warm season in the northern hemisphere and the cold season in the southern.

Our Cold Season.—Now look at Fig. 13.* This shows the

* *Note.*—The picture of the earth in position *C* is not correctly drawn. Too little of the northern hemisphere is seen. The whole of Great Britain is hidden from our eye (the sun), which would mean that on Dec. 22 the sun does not rise above the horizon there, and this is not the case. The sun at noon on Dec. 22 shines in all places south of $66\frac{1}{2}°$ N., and almost the whole of Europe lies south of this line.

earth in position C exactly six months later on December 22nd. By this time the earth has wheeled round to the other side of the sun. Our eye (the sun) is looking straight at the earth as before. The sun is over the prime meridian and it is therefore noon at Greenwich. But everything else is just the opposite of what it was on June 22nd. Look carefully at Picture C and try to answer the following questions:

On December 22nd.—

(1) At what point would a line, drawn from the sun (your eye) to the centre of the earth, meet the surface of the globe? On what circle is this point? On the map find some places on this circle. Are any of them in India? What is this circle called?

(2) Where in the sky would people living on that circle see the sun at noon?

(3) Where in the sky would people living on the equator see the sun at noon?

(4) Where in the sky would people living in Bhopal see the sun at noon?

(5) Calculate how high in the sky the sun appears at noon to people in Bombay, Calcutta, Madras.

(6) Would people at the north pole see the sun? If not, why not?

(7) Why would people at the south pole have no night?

(8) On what part of the earth would people just see the sun on the horizon at noon?

(9) How can you tell from the picture that, at this time of the year, the days are longer as we go south from the equator, and shorter as we go north from it? What is the length of the day at the equator?

(10) What (roughly) will be the length of the day at Bombay?

(11) Will this be the cold season in the southern hemisphere or the warm season? Give a reason for your answer.

The Equinoxes.—But the earth never for an instant stops in its revolution round the sun. It is in a new position day after day. In three months (a quarter of a year) it has moved one-quarter of the way round the sun, and on March 22nd it is now half-way between position C and position A. Let us

call this new position, position *D*. Picture *D* shows the earth as seen from the sun (our eye) in position *D*, on March 22nd. It is again noon at Greenwich. Our eye (the sun) is looking straight at the prime meridian: but it is also looking straight at the equator. Therefore, as the earth rotates, people at the equator will, one after another, see the sun straight overhead at noon. To people on the Tropic of Cancer he will then appear $23\frac{1}{2}$ degrees south of the zenith; to people on the Arctic Circle,

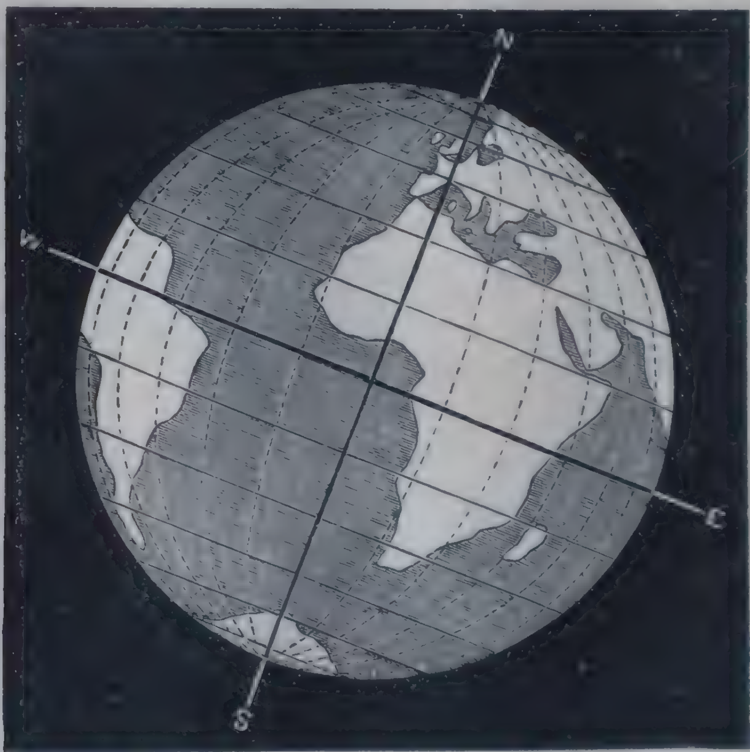

FIG. 14.—Position *D*. The earth as seen from the sun at the Vernal Equinox, March 22. Noon at Greenwich.

$66\frac{1}{2}$ degrees south of the zenith; and to people at the north pole at 90 degrees south of the zenith, *i.e.* just on the southern horizon. To people in Bombay he will appear 18 degrees 55 minutes south of the zenith; in Calcutta 22 degrees 30 minutes south; at Madras 13 degrees 4 minutes south; at Colombo only 6 degrees 56 minutes south. It will be just the opposite in the southern hemisphere. On the Tropic of Capricorn he will appear $23\frac{1}{2}$ degrees north of the zenith, at the Antarctic Circle $66\frac{1}{2}$ degrees north of the zenith, and at the south pole 90 degrees north of the zenith, *i.e.* just on the northern horizon.

Now, what can we tell about the length of the day at position *D* on March 22nd? First, look at the equator. You can see exactly half of the equator circle. Therefore, days and nights will, as before, be equal at the equator. Next, look at the circles drawn parallel to the equator. You see exactly half of each. Therefore, as the earth rotates, people on each of these circles will make a journey half of which is in light and

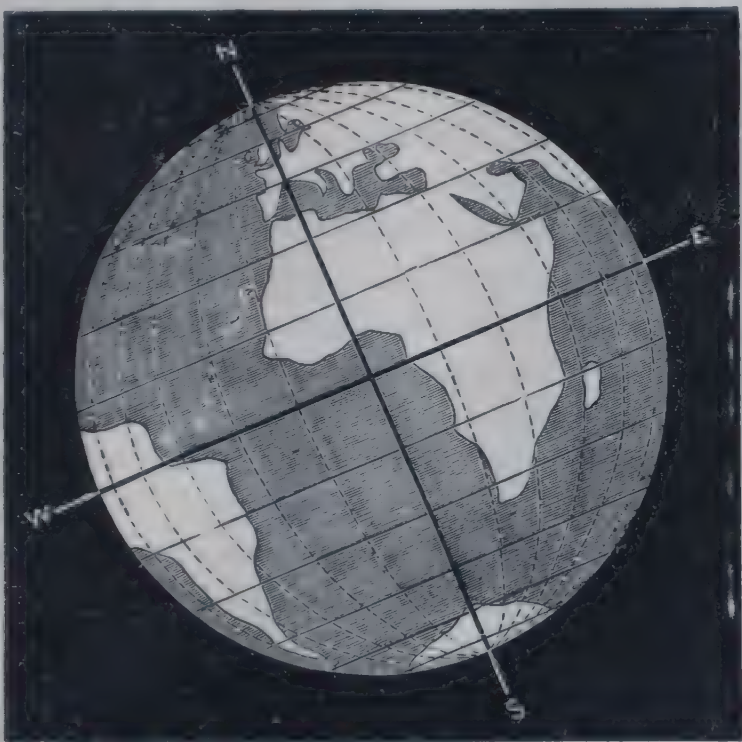

FIG. 15.—Position *B*. The earth as seen from the sun at the Autumn Equinox, Sept. 22. Noon at Greenwich.

half in darkness. Thus, in all parts of the world on March 22nd the days and nights will be equal—twelve hours each. The earth in this position is said to be at the equinox, *i.e.* in the position when nights and days are equal all over the world. This equinox is called the Spring or **Vernal Equinox,** because March, in Europe, is the time when the heat is getting greater and plants are beginning to spring up again, after winter is past.

Position *B* shows the earth as seen from the sun on September 22nd, half-way between positions *A* and *C*. The earth is now on the opposite side of the sun to what it was in position

D on March 22nd. But everything else is the same as on March 22nd.* To people on the equator the sun appears in the zenith at noon. The farther we go north from the equator, the farther south in the zenith does the sun appear: at last, when we reach the north pole, he appears on the southern horizon. As we go south from the equator, the farther north from the zenith does he appear, till, at the south pole, he is just visible on the northern horizon. As always, the farther we go north or south, the more slantingly does the sun shine. From any place in India or in the world the sun appears in the same place in the sky as he appeared on March 22nd. But, of course, the stars seen in the sky are quite different from those seen on March 22nd, because the dark side of the earth is now turned towards the opposite side of the sky.

At this date the days and nights are equal all over the world, just as they are on March 22nd. September in the northern hemisphere is half-way between the warm season and the cold season, when fruits are ripe, and so the earth in position *B* is at the **Autumn Equinox.**

We have now studied four positions of the earth, as it revolves round the sun. It passes day by day, from position *A* to position *B*, then to *C* and then to *D*, and then back again to *A*. Position *A* is opposite to position *C* and position *B* is opposite to position *D*. As the earth steadily moves from one position to the other, the height of the sun in the sky at any place gradually changes too. This means that the amount of heat he gives to any place also changes. From June 22nd (when, at noon, he shines in the zenith at the Tropic of Cancer) to September 22nd, to us in India he appears farther and farther towards the south in the sky day by day. On September 22nd he is overhead at the equator at noon. From September 22nd he appears farther and farther south at noon, day after day. On December 22nd he shines at noon overhead at the Tropic of Capricorn. Then he appears to turn north again, shining farther north in the sky day after day. On

* Hold this page up to the light and look at position *B*. Is it exactly the same as position *D*? The teacher will explain.

March 22nd, at noon, he shines overhead at the equator again, and on June 22nd he is once more over the Tropic of Cancer. Tropic means turning-place.* The Tropics of Cancer and Capricorn are therefore not marked on the globe by chance: they are marked by the sun. We can watch these changes in the sun's position day after day by noticing the shadows at noon lengthening and shortening.

By understanding why the day and night are of unequal length at different times of the year we understand how the seasons change; why it is spring in the northern hemisphere when it is autumn in the southern: why it is winter in the northern when it is summer in the southern. These changes of season make a great difference to man's life on the earth, especially on those parts of it where they are most marked, *i.e.* in places far from the equator. Most of India is near the equator, and there is not much difference in the heat given us by the sun in June and December. But far away from the equator, whether to the north or south, there is a very great difference. In India crops can grow all the year round: in the British Isles they only grow in the spring, summer and autumn seasons.

The earth rotates and revolves regularly and steadily.—If we have a ball in our hands, we can turn it round, now this way, now that way. We can stop it and make it turn on a different axis as often as we like. Now if the earth rotated like this, we should see the sun now here, now there. Sometimes he would seem to rise in the east, sometimes in the west, or the north, or the south. One day he would seem to go across the sky slantwise; on another day he would seem to stop and turn back. Sometimes we should see him in the sky much longer than twelve hours; at other times only for an hour or two hours, or only for a few minutes on the horizon. We should never know where on the horizon he would rise or set, or in

* When the sun is over these turning-places, he seems to stop and reverse his course. On June 22 he is said to be at the **Summer Solstice** (a word which means the stopping-point of the sun), and on Dec. 22 he is at the **Winter Solstice**.

what direction he would cross the sky. And it would be the same with the stars. They would, of course, keep their places among themselves. We should still see the Great Bear and Orion and the Southern Cross, but we should not know where in the sky to look for them, or when they would rise above the horizon or set below it.

If we throw a ball into the air, we can throw it now here now there, now high now low, now fast now slowly. If the earth moved like this, if it made sometimes a big circle round the sun, sometimes a small one, or if it did not move in a regular circle at all, or if it moved sometimes fast and sometimes slow, we should never know what stars we should see in the sky at any time or any place. But we know this is not the case. Our earth always rotates in the same plane and always at the same speed. It also always revolves in the same plane, and steadily all the time. This is a most wonderful thing. It teaches us to know exactly how far the earth will have rotated at any time, and what part of the earth will be turned towards the sun at any time and where, at any time, the sun will appear in the sky to people living at any place in the world. And so, too, with the stars. As the earth revolves steadily in the same plane round the sun, we can tell what stars will be seen in the sky at any place on the earth. Astronomers who have studied the stars can tell us what stars will be rising, what stars will be setting, or what stars will be in the zenith at Bombay, or Calcutta, or London, or at any place in the world, on any night one hundred years or one thousand years after this, and what stars were seen there any night one hundred years ago or one thousand years ago.

Why the Stars do not appear in the same part of the sky at different places.—But though we always see the same stars in the same places in the sky on January 1st every year, or on March 1st, or on September 1st, when we are standing on one part of the earth, yet people living in different parts of the world do not see exactly the same stars in the same places in the sky. Let us see if we can understand why this is so.

When we stand on any part of the earth, we see a certain

horizon round us. If you and I are standing at the same place, we see the same horizon, the same hill to the east, the same temple to the north and so on. But if I am standing at a place which is fifty miles south of you, we do not have the same horizon. I can see some hills or temples or trees which you cannot see, and you can see some that I cannot see. If there is a high mountain between us we can both see it. You say it is in the south and I say it is in the north, and we are both right. It is just the same when we are looking up at the sky. When we stand on any part of the earth, we see a certain dome or arch of sky. This dome measures 90 degrees from the zenith down to the horizon on all sides. As the earth rotates, stars rise on one part of the edge of this dome and set in another part of it. Those stars that rise due east seem to move straight over our heads and set due west.* Those that rise just to the south of east do not pass over our heads. They make a smaller part of a circle in the sky, and set just south of west. In the same way stars that rise just north of east do not pass over our heads. They, too, make a smaller part of a circle and set just north of west. The centre of the circle they make is the north pole star. If we watch, we see that the nearer to the east a star rises, the nearer to the zenith does it pass and the nearer to the west does it set. We cannot see stars outside of the dome of sky of the place we are standing. People in Australia cannot see the north pole star: it is not in their dome of sky. It shines only as far south as the equator. People in India cannot see the stars above the south pole, because they are not in their dome of sky. They only shine as far north as the equator. People in England cannot see the beautiful Southern Cross because these stars are outside their dome. They are in the zenith of places more than 90 degrees south of the zenith of any place in England.

Now, as we travel from one place on the earth to another, the dome of sky we see at night changes. If we stand at the

* This is only true of places on the equator. It is approximately true of places in India. A body rising in the east is, at noon, at an angular distance from the zenith equal to the latitude of the place.

north pole, the north pole star is straight overhead in the middle of our dome, and all the other stars in our dome make complete circles round it. No star rises above the horizon or sets below it. In the same way, standing at the south pole we have quite a different dome and all the stars are new. None of them rises or sets, for they all move in circles round a point in the sky, straight over our heads. (There is no pole star in the zenith of this dome as there is in the zenith of the dome at the north pole.) If we stand on the equator, we are under a new dome and every star we see rises and sets.

If you are in Bombay and, the same night, I am in Colombo, you will see some stars to the north that I cannot see, and I shall see some stars to the south which you cannot see. But there will be many stars which we both see, because your zenith is only some twelve degrees north of mine. But the stars which rise due east of you and pass nearly straight across your zenith, will not rise due east of me and pass over my zenith. No: they will rise a little to the north of my east and set a little to the north of my west. We shall both see them, but they will appear in one part of your dome of sky, and in another of my dome of sky. If we are very far apart, if you are at the north pole and I am on the equator, then the north pole star, which is straight above you in the centre of your dome of sky, will appear on the northern horizon of my dome of sky. The star which I see overhead in my dome of sky you will see on the horizon of your dome of sky. I see it make a great half circle from east to west over my head. You see it just skimming along the horizon.

As the earth rotates, people in all parts of the world see stars rising and setting in their own dome of sky. They give names to the brightest of these stars: they also give names to the groups or constellations of stars. In one place one group is visible: in another, a different group. As we go north or south, we see new groups of stars and we see old stars in new places in the sky, and we see them moving in new circles across it. The stars themselves do not really change: it is the place from which we see them that changes.

CHAPTER III.

THE MOON.

The Moon: Its movement in front of the stars and round the earth.—Look at the moon on a clear night and notice her position among the stars. It is difficult to see small stars near her, and so it is best to wait till she is near a large one. After a few hours you will see she has changed her position among the stars: she has moved among them to the east. As the moon is very much closer to us than the stars are, we can say she has moved in front of them to the east. Night after night she is farther to the east. She rises on the horizon later and later every day, by about three-quarters of an hour. As the moon is farther and farther to the east every night, she must move round our earth.

The moon is always losing on the sun. At first we see her close to the left of the sun in the evening. Night after night she is seen farther and farther to the left of him. Night after night she sets later and later after sunset. In about fourteen days she is only rising when the sun is setting. Then she rises later and later after sunset. At last she rises nine, ten, eleven hours after sunset or just before sunrise. Very soon after this the sun seems to get in front of her and we see her once more in the west as a new moon, setting just after the sun. Again she loses and loses on the sun night after night till, at the end of about twenty-nine days, the sun again seems to pass her just as the hour hand of a clock is overtaken and passed by the minute hand.

Let us try to understand how this happens. Suppose we are looking at the earth from a distance, say, from a great

height above the north pole. The north pole * would be straight below us and the earth would appear as in Fig. 16 moving from west to east, opposite to the direction of the hands of a watch, as is shown by the arrow. If the point **D** represents Dacca in Bengal, then **G**, 90 degrees west of it, represents Greenwich, **N.O.**, 90 degrees farther west, represents New Orleans, in the United States, and **F**, 90 degrees still farther west, represents the Fiji Islands in

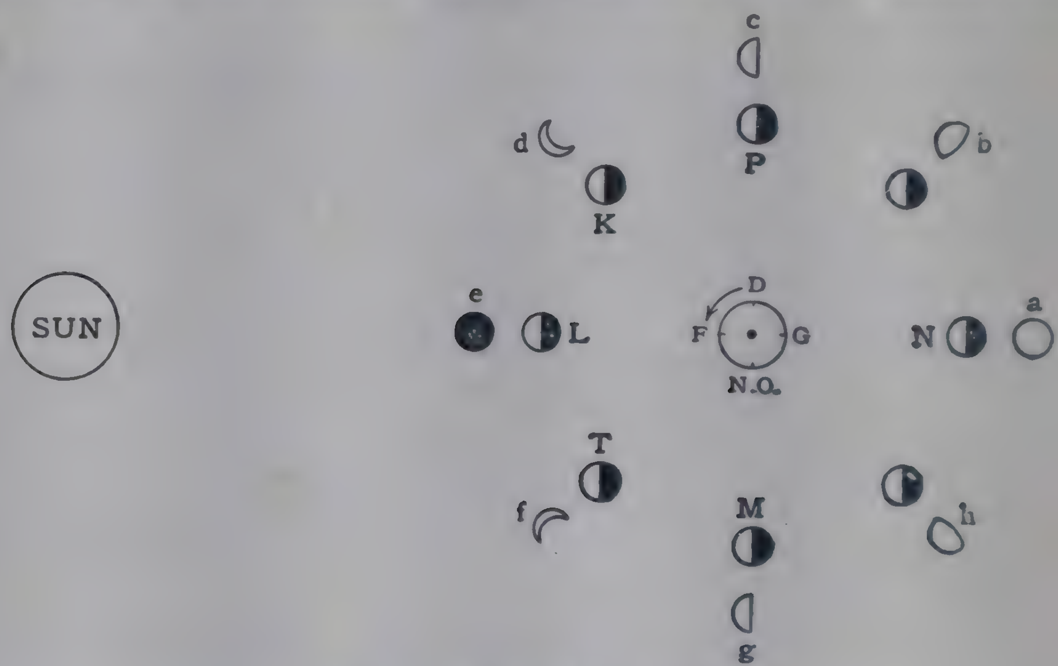

FIG. 16.—Phases of the moon.

the Pacific. The small circles, half white, half black, represent the positions of the moon as she revolves round the earth. The sun is shining at a *great* distance away from the moon and the earth.

First let the moon be at **L** as in Fig. 16. *i.e.* between the earth and the sun. To people on the earth the moon in this position would appear in the sky, if they could see her, near the sun. It would be new moon. As the earth rotates, Dacca would just be coming into sight of the sun. He would appear on the eastern horizon, *i.e.* it would be sunrise at Dacca. New Orleans would be just passing out of sight of the sun. *i.e.* it would be sunset there. This means that in this position the

* The dot in the centre of the middle circle.

moon rises and sets with the sun, in all parts of the world, one after another as the earth rotates. As the side of the moon facing the earth receives, in this position, no light from the sun, the moon would not be visible to people on the earth.

Next, let the moon move to **T,** to show her position a few days later. The sun will rise and set at the same time as before. But the moon will now rise later and set later than the sun. To a person at Dacca the sun is just rising, but the moon is invisible; she is still below the horizon; she has not yet risen. To a person at New Orleans the sun is just setting, but the moon is still in the sky. Again, let the moon move round to **M.** Here, as before, a person at Dacca sees the sun rising: but the moon is on the other side of the earth, and he has to wait for one-quarter of twenty-four hours, *i.e.* six hours, before he sees the moon rise. To a person at New Orleans the sun is setting but the moon is at her highest in the sky, *i.e.* in the south, half-way between east and west. The moon in position **M** rises and sets six hours later than the sun.

Let the moon move round to **N.** She has now completed half her revolution round the earth. Here, to a person at New Orleans, the moon will just be rising and the sun setting, and to a person at Dacca the moon will just be setting as the sun is rising. To a person at Greenwich, half-way between New Orleans and Dacca, the moon will be at her highest at midnight. In this position the moon has lost twelve hours on the sun. She will be at the full.

When the moon moves a quarter of her journey farther round, to **P,** what happens? In this position a person at Dacca sees the sun rising and the moon at her highest at sunrise. A person at New Orleans sees the sun setting but the moon is invisible, being on the other side of the earth. He must wait six hours before he sees her rise. The moon has now lost eighteen hours on the sun. Let the moon move round to **K.** Here she has lost nearly a whole twenty-four hours on the sun. She will, at every place on the earth, as the earth rotates, rise about twenty-one hours later than yesterday's sun, or about three hours before to-day's sun.

In a few days more the moon will have moved back to **L**, and both sun and moon will rise together. Every day the moon loses on the sun. This means she travels round the earth, from west to east. If the earth were motionless and did not revolve round the sun, the moon would take $27\frac{1}{3}$ days to make this journey. But as the earth is, all the time, also making a journey in a great circle, the time taken by the moon to go completely round the earth is $29\frac{1}{2}$ days. This is a lunar month, and twelve lunar months make only 354 days. The year of 365 days is divided into twelve civil months, January, February, etc. A lunar month is, therefore, shorter than a civil month. In the year of 365 days the moon revolves round the earth twelve times and a little more. It is new moon on January 1st of this year. How many days old will the moon be on January 1st of next year ?

The Phases of the Moon.—But the moon not only changes her position in the sky and in front of the stars. She also seems to change her shape. These changes are not sudden but gradual ; they are called phases. Fig. 16 shows these phases. The moon has no light of her own : she is a dark body. She only reflects the light coming from the sun and we say she is bright. The sun can only light up one half of the moon at a time, namely the side turned towards him. Seen from the sun, the moon is always fully lighted up. Her bright side is always turned towards him. It is not always turned towards us—only at full moon. The nearer she is to the line joining the earth and the sun, the less do we see of her bright face. Every one has noticed that when the moon is full she is on the opposite side of the earth to the sun. If the full moon is rising, the sun is setting, and when she is setting it is just sunrise. When the full moon rides high in the sky at midnight, the sun is shining high in the sky on the other side of the earth ; it is there noon. Fig. 16 shows that the moon, in position **N**, is a bright circle (**a**) as seen from the earth ; as seen from New Orleans, she is rising full ; as seen from Dacca she is setting full.

Next, suppose we observe the moon a week after full moon.

She now rises not at sunset but about midnight. She no longer appears round but only what we call half-moon (**c**). We can only see half of her lighted-up face. In what position is the moon when she rises at midnight? Fig. 16 shows it is midnight at Greenwich and from Greenwich the moon is seen rising at position **P**, *i.e.* when she has completed three-fourths of her revolution and has lost eighteen hours on the sun. During the next few days the moon loses more and more on the sun and becomes crescent-shaped. In position **K** she has this crescent shape (**d**) and at last, when she has moved to position **L**, she is lost in the sun's rays and the whole of her bright side is turned away from the earth, so that none of it is seen. It is new moon. Look at her again a few days later. She is once more to the left of the sun and is seen as a thin crescent. She is now in position **T**. You can only see a thin part of her lighted-up face (**f**). As the moon appears to get farther away from the sun and sets later and later, we see more and more of her bright half till she gets to half-moon (**g**) in position **M**. She is now south of sunset.

These are the phases of the moon; they are different every night. When she is between the earth and the sun, her lighted-up face is turned away from us, we cannot see her, and we call it new moon. Then she grows, or waxes, for about a week till we see her as half moon with the bright half turned to the sun, *i.e.* to our right. In another week she has waxed to full moon and we see the full circle shining because we are between her and the sun. A week later she has waned to half-moon with the bright part still turned to the sun, *i.e.* to our left. In another week she is back to new moon and we cannot see her.

The moon is a wonderful lamp that gives light to man's dwelling-place. By watching its regular movements in the sky, man has learned to use it as a kind of clock, which measures time for him. The word month means a moon-tide. In all parts of the world religious festivals are fixed by the position of the moon. Its shape tells us how old the moon is. From Fig. 16 and by your own eyes answer the following questions:

How long is it before or after sunrise when (1) the full moon sets ? (2) the half-moon rises with her bright side turned to the right ? (3) the half-moon sets with her bright side turned to the left ?

A Fijian islander sees the full moon setting—what time is it at Dacca, Greenwich and New Orleans ? To answer this question we suppose that the earth in Fig. 16 has rotated three-quarters round, *i.e.* till **F** is in the position of **D**. The full moon has just set at Dacca : when will she set at Calcutta $1\frac{1}{2}$ degrees farther west, and at Karachi 27 degrees farther west ? People at Mandalay see the moon rising : how long will people at Calcutta, Madras, or Bombay have to wait till she appears above the horizon ? Does the moon set earlier in Colombo or Madras ? Suppose **G, D, F,** and **N. O.** are places on the equator. They will each have just 12 hours of daylight. Will they have just 12 hours of moonlight ?

Eclipses : why they do not take place every month.—We have seen that the moon revolves round the earth once in $29\frac{1}{2}$ days. Now, if she moved exactly in the plane of the ecliptic, she would come straight between the earth and the sun at every new moon. That means that at every new moon we could not see the sun; his light would be cut off from reaching us, and we should have an eclipse of the sun. Eclipse is a Greek word meaning "failing." So, too, at every full moon, the earth would be straight between the sun and the moon, *i.e.* the sun's light would be cut off from reaching the moon, the earth's shadow would fall on her and she would be eclipsed. We know that this does not happen every month. The reason is that the plane of the moon's orbit is not the same as the plane of the ecliptic. It is inclined to it at an angle of 5 degrees.*

Let us try to understand this. Imagine the sun as a large ball floating in an ocean, or even in a tub of water : and the

* This explains why in India the moon, like the sun, gives more light than in England—she rides higher in the sky. Far from the equator, near the poles, the sun never rises high above the horizon : neither does the moon.

earth as a much smaller ball, also floating, half submerged in this water and moving round the sun in a great circle. Imagine the moon as a still smaller ball moving round the earth in a small circle, not on the level of the water, but slantwise to it, so that during one half of its revolution round the earth it is slightly under the water, and during the other half slightly above it. Now, the sun, moon and earth will be in a straight line only (1) when the moon is just coming out of the water or just passing into it; (2) when the point where the

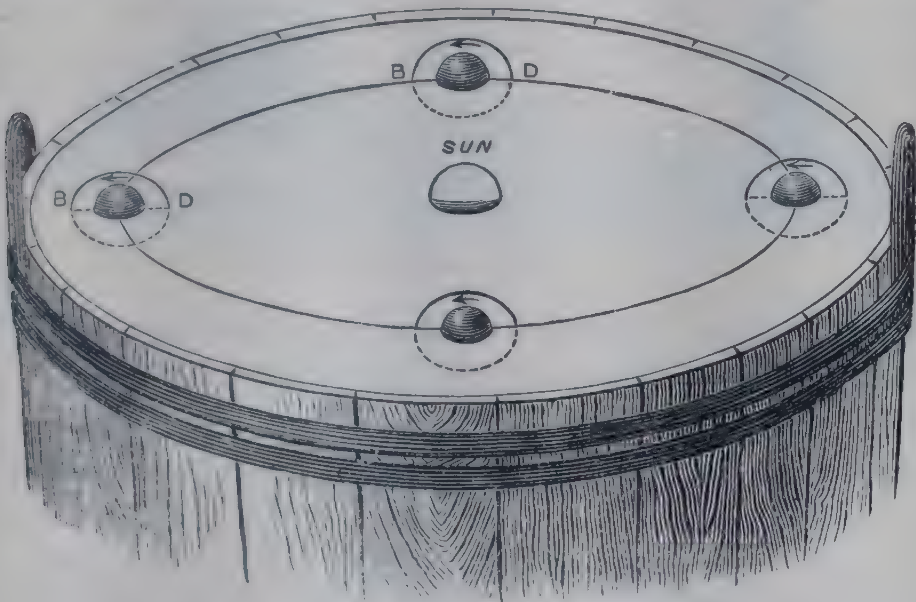

FIG. 17.—Showing how the plane of the moon's orbit cuts the plane of the ecliptic.

moon just enters or leaves the water is straight in front of the earth or straight behind it, looking from the sun.

Fig. 17 shows this. The small circle round the earth is the orbit or path of the moon, and the dotted part of this circle is the part of it below the level of the water. *B* is the point where the moon enters the water and *D* the point where it leaves the water. This means that *B* and *D* are the points where the moon's orbit cuts the plane of the earth's orbit or plane of the ecliptic. And it is only when one or other of these points lies straight in front of the earth, or straight behind it that an eclipse can take place. The sun and the earth do not, of course, float in an ocean of water but in space,

but the positions of the sun, moon and earth are as shown in Fig. 17.

Eclipses: how they are caused by the moon.—Fig. 18 shows a lamp shining on a small ball *C*, and this small ball throws

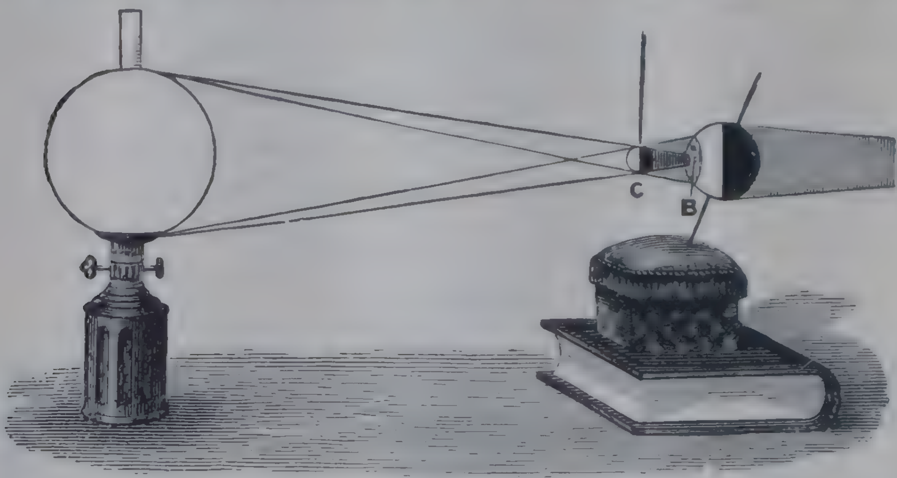

FIG. 18.—Total eclipse of the sun.

a shadow on to a larger ball behind it. As *C* is a globe, the shadow it casts is circular. In the middle of this shadow there is a dark part on which no light from the lamp can fall. The rest of the shadow is not so dark, because a part of the lamp light can reach it. The lamp stands for the sun, the small ball for the moon and the larger ball for the earth. In this position, to people in the dark centre of the shadow cast on the earth the sun will be invisible and there will be a total eclipse of the sun. At other places in the shadow, as at *B*,

FIG. 19.—Eclipse of the moon.

for example, all of the sun's rays will not be cut off, part of the sun will be visible and people there will see a partial eclipse of the sun.

Fig. 19 shows a lamp shining on a large ball which casts

a shadow in which hangs a small ball. The lamp is again the sun, the larger ball the earth and the smaller one the moon. In this position the moon has moved round to the side of the earth away from the sun. She enters the shadow of the earth and passes through it and people on the dark side of the earth (where it is night) see the moon gradually becoming darkened and then gradually becoming bright again. There is an eclipse of the moon. Figs. 18 and 19 show that an eclipse of the sun can only take place at new moon and an eclipse of the moon only at full moon.

Before men understood the reason for eclipses, they were filled with fear when these took place.

CHAPTER IV.

THE PLANETS.

The Planets : their movements in the sky.—So far we have studied the earth on which we live, the sun, the moon, and the stars which are so very far away that they appear small to us. But there are other bodies in the sky which are like stars but are not real stars. Stars are really distant suns, burning hot like our sun, and shining by their own light, but these other bodies have no light of their own. They give out, or reflect, light which they receive from the sun just as our moon does. The stars seem to keep their places in the sky but these bodies seem to move about the stars. The stars are far, far behind them so that what we see is their movement. They are therefore called planets, a word which means 'wanderers,' because they seem to wander about the sky. But they do not wander by chance here and there. By watching their movements men have found that they really move steadily in circles round the sun as our earth does and in the same direction. Astronomers can tell exactly where each one of them will be in the sky ten years hence or one hundred years hence (Fig. 20).

The Interior Planets.—Our earth revolves round the sun at a distance of $92\frac{1}{2}$ million miles from the sun. Two of the planets, Mercury and Venus, revolve round the sun in smaller circles than the earth does. This means they are nearer the sun than our earth is, and they are therefore called interior planets. Five others, Mars, Jupiter, Saturn, Uranus and Neptune revolve round the sun in much larger circles than our earth does. They are therefore called exterior planets.

Counting our earth there are, therefore, altogether eight planets.

If you stand away from a lamp in a dark room and let some one make a ball revolve round this lamp very nearly in the line of your eye, the ball will appear to swing across the lamp,

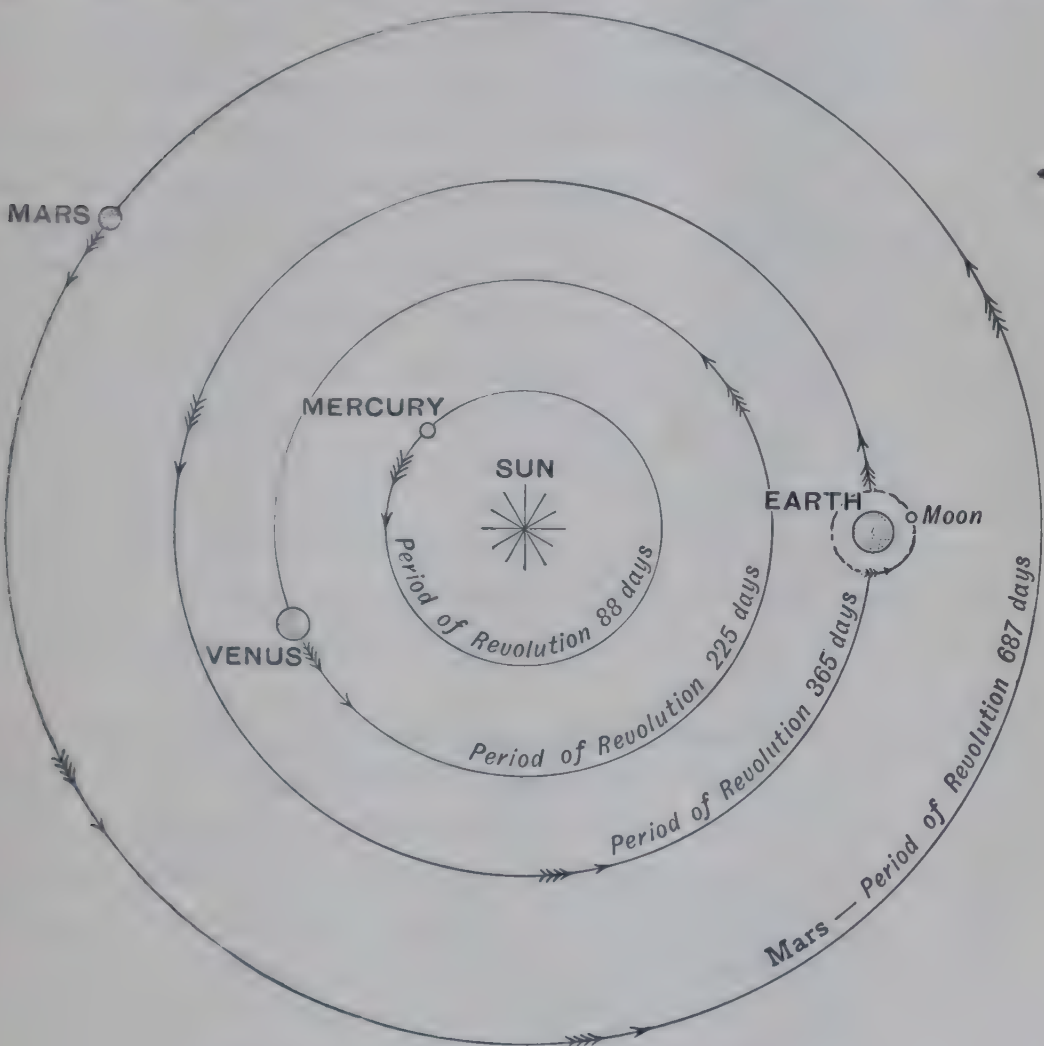

FIG. 20.—Showing the orbits of some of the planets.

first in front of it and then behind it, backwards and forwards. This is how the interior planets appear to us to move. Mercury is the nearest of these planets to the sun, and so it does not seem to swing far to the left or right of the sun. It always appears near the sun. When it is on our left of the sun, it follows the sun in its daily course (owing to the earth's rotation), and sets just after it and rises just after it, and we cannot see

it in the brightness of the sunset or sunrise. When it is on the right of the sun it sets just before the sun when we cannot see it, and it rises just before the sun is up and this is the only time we can see it. Venus makes a larger circle round the sun than Mercury, and therefore she seems to swing farther to its left and right, and so we can see her much better. Like the moon, she goes through certain phases. When passing in front of the sun, Venus is, of course, much nearer us than when she passes on the far side of the sun and, so, she then appears to us much larger and brighter. But in this position we can see only a crescent of her lighted-up face, just as happens with the moon when it is nearly in a line between the earth and the sun. When Venus is on the left or right of the sun, she of course looks smaller, being farther away, and we only see the half of her bright side turned to the sun. When on the far side of the sun Venus appears still smaller, but we then see the whole of her bright side. These changes cannot be seen by the naked eye—only through telescopes. As Venus is such a bright body and is not far from the sun, she is called the Morning Star when she rises in the east and the Evening Star when she is in the west.

The Exterior Planets.—The exterior planets, Mars, Jupiter, Saturn, Uranus and Neptune, as they make much larger circles round the sun than our earth does, never come between us and the sun, and so they do not show phases like Mercury and Venus. When Mars is on the opposite side of the sun to us, it is then farthest away: when it is on the same side of the sun as we are, it is then nearest to us and can best be seen. To the naked eye it appears reddish, but through a telescope it has a bright surface with dark markings. The bright parts are supposed to be land and the dark, sea. Unlike our earth, Mars has much more land than water. Owing to its nearness, at certain times, we know more about this planet than about any other.

Beyond Mars there are hundreds of very small planets, called asteroids, making a wider circle round the sun. They are not visible to the naked eye.

Outside the orbit of the asteroids is Jupiter, the largest of the planets, and five times farther from the sun than our earth is. Its size makes it the brightest of the planets next to Venus. Seen through a telescope Jupiter appears to be covered by dark markings supposed to be clouds. Farther out still from the sun is Saturn, nine times farther from the sun than we are and taking about thirty of our years to make one revolution. A telescope shows this planet surrounded by three rings, one outside the other, and these are supposed to be a great stream of small moons revolving round Saturn. Of the two outmost planets, Uranus and Neptune, little is known because they are at an immense distance from us and from the sun.

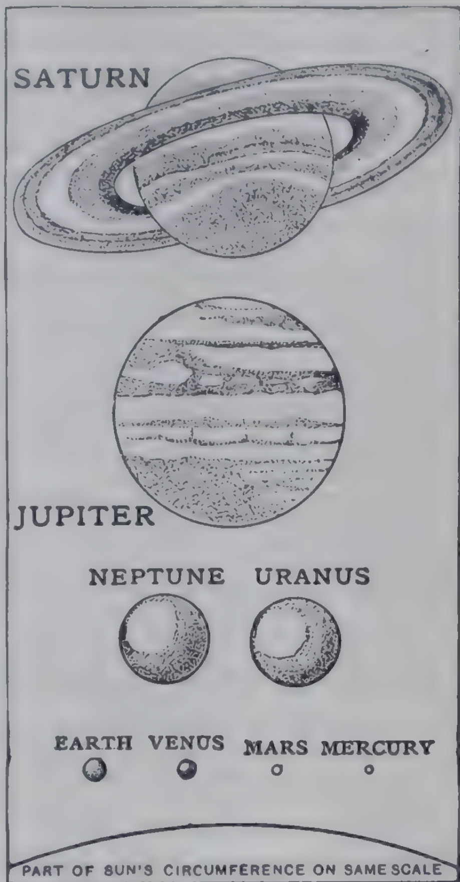

FIG. 21.—Showing relative size of the planets.

All the eight planets revolve round the sun and, so, they belong to the sun's family or to the solar system. Mercury, Venus and Mars are smaller than the earth: the others are all much larger. Those farthest from the sun, as they move in much wider circles than the earth, take much longer than we do to wheel round the sun. Thus, the year of Neptune is more than 160 of our years. Each of the planets rotates on an axis; some more slowly than our earth, some faster. Mars has a day of 24½ hours; Jupiter a day of only ten hours. Their planes of rotation are inclined to their planes of revolution, so that they have 'seasons' as our earth has. We have one satellite, our moon, which moves round our earth. Some of the planets also have moons. Mars has two, Jupiter seven, and Saturn ten. Like our earth, the planets have no light or heat of their own, but get these from the

sun. We only see them shining because the sun shines on them and makes them bright.

Comets.—Besides the planets there are members of our solar system called Comets. They are of different sizes and shapes. Some are like a small planet, or star, with a bright tail millions of miles long. Some are attracted to our sun, pass round him and never come back. They are only visitors. Others belong to our system because they come back at intervals. Thus, Encke's comet revolves round the sun every five years and Halley's comet once every seventy-four years. But they are different from planets because they do not move in circles but in long egg-shaped curves, called ellipses, and they move in a contrary direction to that of the planets. They are supposed to be made up of swarms of very small bodies.

Gravitation.—We have now learned how our earth, the other planets and the comets move regularly round the sun in orbits. Some of these are circles or nearly circles, and others are ellipses. All these bodies have the sun as centre round which they move. They do not move now here, now there. by chance. If the sun were blotted out, their movements would be quite different. Is it not wonderful that these bodies all move so steadily through millions and millions of miles of space? Astronomers can calculate exactly where in the sky each of them is to-day, where each was one hundred years ago and where each will be one hundred years hence. There must be a reason for this. The reason is that they all obey some law. Astronomers have found out that the earth and the planets as they wheel round the sky obey the same law. This law is the Law of Gravitation.

If you throw a stone into the air or shoot an arrow, they each move away from you. But they do not move straight all the way. If you watch the stone, or arrow, carefully, you see it moves in a curve. The reason is that the earth pulls it down. If there were no force pulling the stone to the earth, it would move in the direction it was thrown and never stop but go farther and farther away through space.

Take a stone, tie it to one end of a string and with the other

end in your hand whirl it round your head like a sling. Why does the stone not fly away ? Because the string prevents it. The pull of the string makes the stone move in a circle. If you suddenly cut the string, or if it breaks, the string no longer pulls the stone and it flies away.

Now, it is just the same with the earth and the planets as they move round the sun. Each of them is acted on by the pull of the sun. Left alone, they would move through space in a straight line. If their movement forward in space were to stop, our earth and all the planets would be pulled into the sun. If the pulling force of the sun were to stop, they would each move in a straight line farther and farther away through space. But the pull of the sun on them causes them to move in circles round the sun just as the string causes the stone to move in a circle.

Gravity—Why the moon moves round the earth.—In the same way our earth attracts or pulls the moon. If this force acted alone, the moon would be pulled to the earth. But the forward movement of the moon, if it acted alone, without any pull from the earth, would carry the moon farther and farther away through space. But the pull of the earth on it makes the moon move in a circle round the earth. It is the same with the moons which, in telescopes, we can see moving round Mars and Jupiter. Each, left to itself, would move in a straight line ; but the pull of the planet on them makes them move in a circle or very nearly a circle. This pulling force is called Gravitation. The pulling force of the earth is called Gravity.

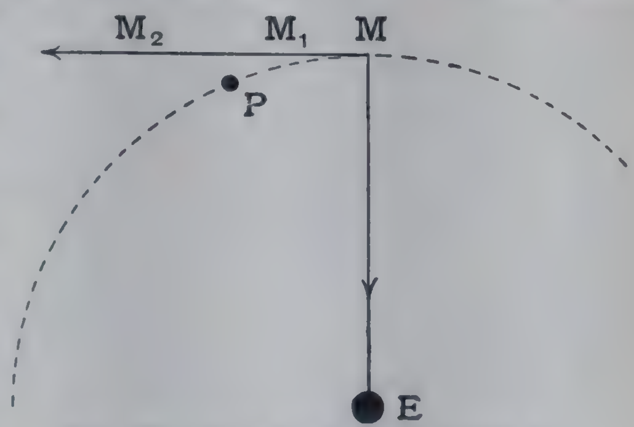

FIG. 22.—How the moon is pulled by the earth.

Here is a diagram which shows how the moon is held in its circular orbit by the attraction of the earth. *E* is the earth

and M the moon. If gravity ceased to act, the moon would move in the direction of the straight line $M\ M_1\ M_2$. Say in one second it would move from M to M_1. But during that second gravity also acts and we find the moon at P instead of at M_1. Thus the pull of the earth, or gravity, has brought it to P instead of to M_1.

The Moon, the Sun, the Planets and the Stars—What are they ?—We have now learned how the earth moves and the moon and the planets, and a little about the places in the sky, of the sun and the stars. Let us now see what they are like.

The Moon.—The moon is only some quarter of a million miles away from us and, as it is much the nearest to us of the heavenly bodies, we know more about it than we do about any of the others. Every one knows the face of the moon is not all the same. Even with the naked eye we can see marks on it. Through even a small telescope we can see its surface is made up of dry, bare hills, mountains and valleys. The mountains are huge volcanoes which tells us the moon was once full of fire; but now it looks dead. Photographs and maps of it have been made and some of the mountains have names. There is no water, no rain, no snow, no lakes, no rivers. But, stranger still, there is no atmosphere. Without air there can be no plants nor animals. Nor can there be any sound. It is a world of silence. The moon, like our earth, does not shine by its own light: the bright part we see is the part lighted up by the sun: where this light does not shine we cannot see the surface.

A curious thing is that we always see the same half of the moon: no one has ever seen the other half. When the moon is full, we see the whole of this half; at other times we see only a part of it, but exactly the same half is always turned towards us. And yet the moon rotates like the earth. What does this mean? It means that while the earth turns on its axis twenty-nine times, the moon only turns on its axis once. Our days and nights are twelve hours long: the moon's days and nights are each twenty-nine times as long. Each place on the moon is lighted up for 29×12 hours, and is dark for

the next 29 × 12 hours. As there is no atmosphere to catch and keep the heat of the sun, the side which is turned to the

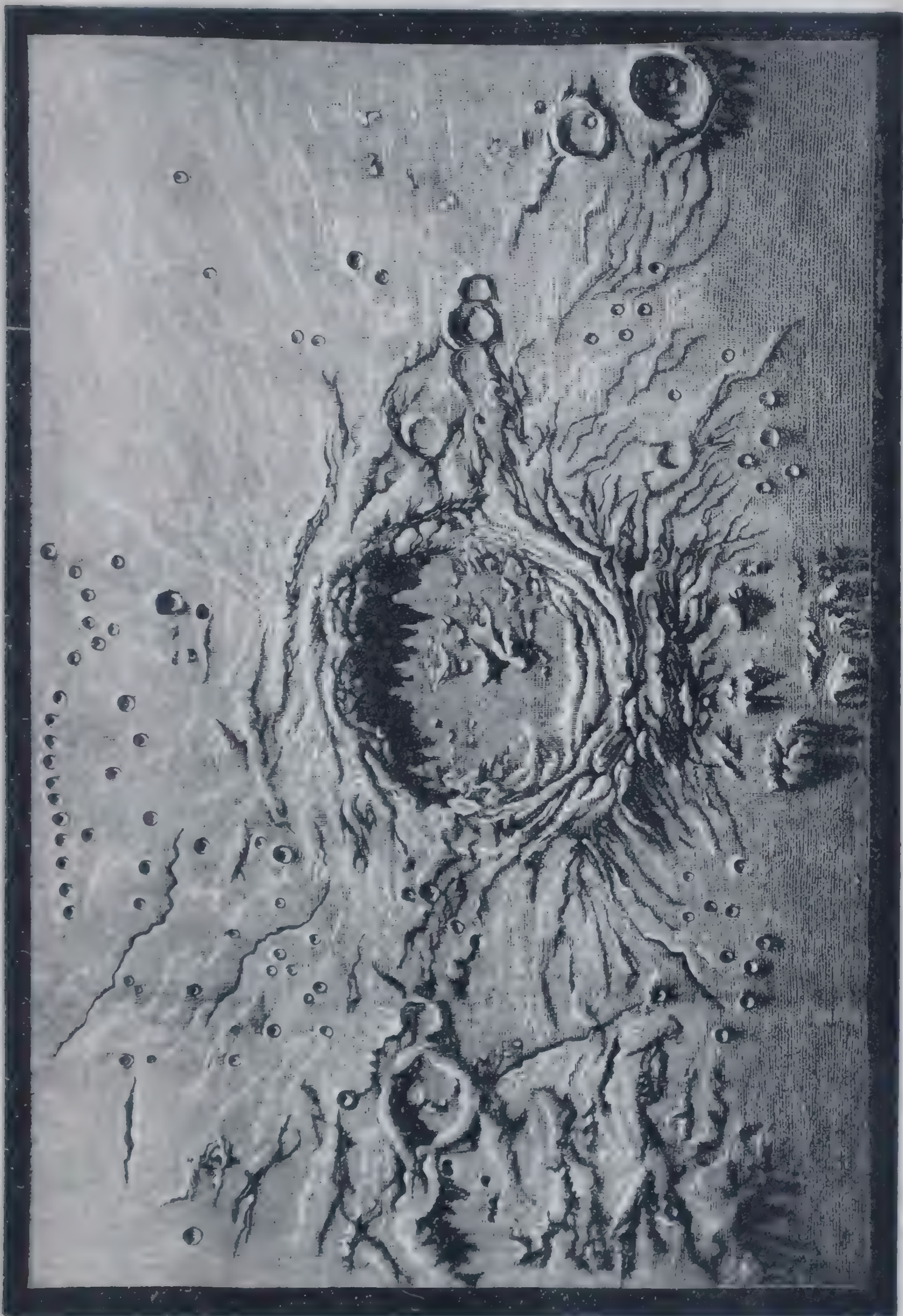

FIG. 23.—A dead volcano on the moon seen through a telescope.

sun must become intensely hot and the opposite side must be intensely cold.

The Sun.—The sun is the centre of the solar system. We see it is round and large, and hot and bright, but how large and how hot, and how bright our minds cannot understand. The size, or volume, of the sun has been measured to be $1\frac{1}{2}$ million times as large as our earth, but though we can understand these figures we cannot understand what they mean. The sun is so hot that nothing there is solid, nothing liquid: everything is just blazing vapour. The sun is made up of intensely hot gases. Some parts are denser than others, but all is gas. By the help of instruments men have found out some of the gases of which the sun is made. This heat pours out without stopping from the sun all round into millions and millions of miles of space and yet the sun seems never to get any cooler. The sun also gives out light which unceasingly speeds out on all sides to the farthest planet and far, far beyond it. Even at the distance of ninety-three millions of miles it is so bright that we cannot look at the sun. The sun is the only giver of light (except a little light from the distant stars) to all the planets and their moons. When we see the large planet Jupiter or Saturn, the light or brightness we see has first passed from the sun to the planet through millions and millions of miles and then been reflected back through more millions of miles to our eyes. The bright circle of the sun which we see is only the denser part of it; round this is a blazing atmosphere with flames thousands of miles high. Through a piece of dark glass in a telescope, dark spots, called sun-spots, occasionally appear to move across the sun's disk. They are really in the sun itself, and from them we learn that the sun moves on an axis like his planets and the moons of these planets.

The Planets have no light of their own. They reflect the light they receive from the sun. If they did not do so, we could not see them. The moon, too, shines by reflected light. She reflects the light she receives from the sun. At full moon we see the whole of her face that is lighted up by the sun; at half-moon we see only one-half of this lighted-up face. The earth, too, reflects light like any other planet. How do we know this? Is there earth-light as well as moon-light?

Yes: and every one of us has seen it. When the moon is very young, we see a bright thin crescent of the face she turns to the sun. But we can also see the rest of her circle very dimly lighted up. This dim part is really reflecting the light she receives from the earth; it is earth-light. It has first come from the sun to our earth, then been reflected from our earth to the moon and then reflected back from the moon to our eyes.

The Stars.—A body which gives out its own light and heat is called a star. Thus the sun is a star. It looks brighter than any other star, because it is much nearer to us than any other. But many stars are much larger than the sun. If one of the largest stars which we see were as near to us as our sun is, it would fill nearly the whole sky over our heads. With the naked eye we can count many thousands of stars, but the telescope shows us many millions more. We say some stars are very bright and others are less bright, but the brightness of a star does not tell us how large it really is. A very large star very far away looks less bright than a smaller star closer to us. The nearest star is nearly 275,000 times farther away from us than the sun is. Our minds cannot understand this, but it means that our sun and all his planets round him, occupy only a tiny spot in the great world of space—they are like drops in a great ocean. On some clear night find Sirius, the brightest star we can see. It is in a line with the three stars in the middle of Orion. This star is about five lakhs of times farther from us than the sun is and it gives out forty times as much light as the sun does. Even light, which travels at the rate of nearly two lakhs of miles a second, takes over eight years to come to us from Sirius. If we were able to reach the stars, the sun would only be the first step in a journey which would take thousands of years.

CHAPTER V.

THE ATMOSPHERE.

Its Usefulness.—The moon is a globe like the earth: it rotates on its axis as our earth does. Therefore there are days and nights on the moon, just as there are on the earth. Along with our earth the moon revolves round the sun, and its plane of revolution is inclined to its plane of rotation, just as ours is. Thus, one hemisphere of the moon is inclined towards the sun at one part of its revolution and the other hemisphere is inclined towards him at another part of its revolution, *i.e.* when it has wheeled round to the other side of the sun. Thus in some ways, the moon, though smaller than our earth, is very like it.

But the moon could never be the home of man as our earth is. The reason is simple. It has no atmosphere. On the moon there is no air to breathe. There is no sound. Not a whisper is ever heard. There is no atmosphere to act as a screen against the sun's heat and light. Therefore, the half of the moon where the sun is shining, is much hotter than we could bear. On the other half where it is dark, *i.e.* where the sun is not shining, the heat very rapidly radiates off its surface into space and the cold is intense. Every part of the moon's surface is intensely hot during one half of its rotation and intensely cold during the other half. The rocks (and there seem to be rocks on the moon) are thus constantly being crumbled down. Photographs of the moon show its surface is covered with broken rocks and with lava vomited out of volcanoes which are now dead. There is no atmosphere to hold moisture. Therefore there are no clouds, no rain, snow,

hail or dew. Through telescopes the surface looks a bare, dry wilderness of rubbish. No animal can live: no plant can grow.

It is our atmosphere which makes the earth a dwelling-place for us so different from the moon. Let us see how it does this work. Every one knows that men and animals need air to breathe—without air, life would be impossible. It also carries sound: without it, our world would be a place of silence. Man uses the air to help him in many ways. But the air does much more work than this. Our first question is, What is the atmosphere and what is it made of?

The Density of the Air varies with Altitude.—The atmosphere is an ocean of invisible gas floating and flowing over the earth. It is really a part of the earth, for it goes with the earth as it moves through space. We live at the bottom of this ocean just as fish live in the ocean of water. This ocean of gas is not very high. It may extend for about 200 miles above the earth. No one knows exactly. But we know this; it becomes rapidly thinner and thinner as we go up, so that it is difficult to say where it ends.

When we say that air is more dense near the surface of the earth than it is far up, we mean that there is more air in a cubic foot of it in one case than in the other. If air is put under pressure, *e.g.* if we pump it into a bicycle tyre, its particles are crowded together and it is made denser. At the bottom of the ocean of air the atmosphere is pressed down by all the air above it. At the height of 1000 feet the air is pressed down by all the air above that level, and so on. Hence the lowest air is under most pressure, and that is why it is densest. Even five miles up, the air is so thin that there is not enough to breathe. That is why it is so difficult to climb to the top of high mountains, and that is why the brave men who in 1921, 1922 and 1924 tried to reach the top of Everest had to give up the attempt. If two men fly in an aeroplane very high in the sky, they must shout to each other in order to be heard. The air at that height is too thin to carry sound easily. Thus we must picture in our minds this ocean of air as much denser

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near the earth than it is far up. One half of the whole mass of the atmosphere lies below the height of three and a half miles. If we could climb to the top of Everest, we should pass through nearly three-fourths of the mass of the atmosphere lying over that part of the earth.

What Air is made up of.—Our atmosphere is made up almost entirely of two invisible gases mixed together. About four-fifths of the air is **nitrogen** and one-fifth **oxygen**. Without oxygen we could not live, but we could not breathe pure oxygen. When mixed with nitrogen, the oxygen is weak enough for us to breathe it. An airman has flown to a height of seven miles above the earth, where the air is very thin and there is not enough oxygen to keep a man alive. He could only do this by carrying up with him cases full of oxygen. The explorers who climbed almost to the top of Everest in 1924 did this too.

These two gases, oxygen and nitrogen, make up the air, but there are other things in it as well. It contains a very small quantity—only about three parts in every 10,000 parts of air—of an invisible gas called **carbonic-acid gas**. This is the chief food of plants, which they take in through their leaves. Without this gas in the atmosphere no plants could grow on the earth.

Lastly, air contains another gas called **water-vapour**—sometimes much of it, sometimes little. This water-vapour is just water in the form of an invisible gas. When we heat water in a vessel, or when the sun shines on lakes, rivers or the sea, some of the water in them evaporates; that is, it turns into invisible vapour. The water which we could see in the vessel is now turned into a gas in the air, which we cannot see. Being lighter than air, water-vapour rises from the vessel or the sea, and floats in the air. When the air is cooled, this water-vapour is condensed into rain, mist or dew. Water is thus always being evaporated, sometimes fast, sometimes slowly, into the air and always being condensed back into some form of moisture. These changes take place in the atmosphere. Without the atmosphere we could have no clouds, no rain,

no mist, no snow. Seen through telescopes, the planet Mars seems to have a white cap at either of its poles. If this is snow, it means that Mars has an atmosphere.

Besides these gases, air also contains millions and millions of tiny **dust particles**. These are not gases, but solids infinitely small. In a dust-storm we say the air is full of particles which we can feel as well as see. But even in the purest and densest air there is always an immense quantity of these particles floating about. We can prove this by allowing a beam of light to fall into a dark room. The dust particles can be seen swarming in multitudes in the beam. Our air is full of them though we cannot see them. Particles of dust in our houses or on our clothes are a nuisance, and we try to get rid of them. But in the air they are very useful. Without them, as we shall see, the atmosphere could not help us nearly so much as it does. A great deal of this fine dust is always sinking into the sea, but the air is constantly getting fresh supplies. Currents of air sweep it up from the ground. Smoke is full of tiny particles of carbon. Volcanoes also vomit up clouds of it, and the winds scatter them and carry them to the other side of the world. Some of it comes from the sky. Every one has seen meteorites or shooting stars at night. They are pieces of rock, large and small, perhaps the fragments of some small planet that has burst. They are pulled by gravity towards our earth, and in passing through the atmosphere become so heated by friction that they blaze up and burst into fine dust which remains in the air. Almost any night we can see a few, but they are continually falling and bursting—millions of them every day and night. A few meteorites are so large that only their outside surface is burnt into dust, and they fall as heavy solids on the ground. Such meteorites can be seen in museums. Several have fallen in India. The dust thus brought into our atmosphere is called meteoric dust, because it comes, not from our earth, but from the outside world of space.

Now, each of the components of the atmosphere helps to make the earth a suitable dwelling-place for man, and we go on to study how this useful work is done. The most important

things which affect man's life are light, heat and moisture. Without light no plants or animals could live. It makes a great difference to man whether he dwells in very cold or very hot, very damp or very dry parts of the world. In cold countries his clothes, his shelter, his work and his habits are different from those of people living in warmer countries. Contrast the life of the Eskimo in the far north, always fighting against cold, unable to grow crops and with no timber to build houses, with the life of the people in the hot, damp forests in Africa, where plants grow very quickly, where fruits are plentiful and where few clothes and little shelter from the cold are needed. How different is life in parched and barren deserts, such as the Thar, from life on a well-watered delta, where field touches field for miles and miles !

How the Atmosphere affects the Sun's Light.—Now, the atmosphere does not make light. All our light, except a little from the stars, comes from the sun. But, in a way, the atmosphere stores light and scatters light. The atmosphere does not make heat—nearly all the heat on the earth comes from the sun. But it stores heat, it regulates heat, it scatters heat. Again, the atmosphere does not make moisture. But it stores moisture, it regulates moisture and it distributes moisture. The atmosphere has therefore a great deal to do with the life of man.

It is difficult to imagine what kind of a world ours would be without this ocean of air all round us. We cannot really see the rays of light coming from the sun. We can only see things on which these rays fall and we say they are bright. At night the sun's rays are, of course, passing through space high up in the sky, but we cannot see them and we say the sky is dark, because there is nothing for them to light up except the moon and the planets. Now, the atmosphere is a very thin screen which is lit up by the light of the sun, and this screen reflects and scatters his light in every direction. The dust particles in the air do most of this work of scattering light. Without them only those parts of the earth on which the rays of the sun strike would be bright. The inside of our houses, even at

noon, would be dark; on a cloudy day we should have to light lamps in order to see our way. In the daytime the sun would probably appear in dazzling brightness shining out of a black sky in which the stars would be visible. The blue colour of the sky and the red colours of sunrise and sunset are probably caused by the dust particles in the air. The rising moon often appears red for the same reason. After the sun has set, darkness does not come on for some little time. His rays still light up the atmosphere above our heads, which scatters a little light over our part of the earth. Without our atmosphere and its dust particles we should be in black darkness the moment the sun set and until he appeared above the horizon again. Photographs of the moon (which has no atmosphere) show us that the places on it where the sun shines are very bright: places where his rays do not strike are pitch dark. There is no half light, no diffused light anywhere. Our atmosphere, by softening and scattering the light from the sun, makes the earth a fitter dwelling-place for us.

How the Atmosphere affects the Heat from the Sun.—The rays of heat pour out from the blazing sun on all sides. A few of these rays are caught by our tiny earth, ninety-three million miles away. If the earth were farther from the sun, it would catch fewer rays and so get less heat; if it were nearer the sun, it would catch more rays and get more heat. Every one knows the sun's heat is greatest when he is high in the sky. How much heat any place on our globe receives depends on the angle at which the sun shines on it. If he is shining straight down, a place receives much more heat than when he is shining at a slant, and the greater the slant the less heat is received. This can be seen by making an experiment. Take a board—say a black-board. At noon, when the sun is at his highest point in the sky, hold it so that the sun's rays fall straight on it. Measure the size of the black-board's shadow. The black-board has shut off from the ground so many bundles of the sun's rays. When you take it away, these rays pour down on the ground and heat just that part of the ground that was covered by the shadow. Now make the same experiment when

the sun is low in the sky, in the morning or evening. Again hold the black-board so that the sun's rays fall straight on to it, and now measure the shadow. It is much larger than before. Here, too, the size of the shadow tells us how much of the ground was heated by the sun's rays which are now stopped by the black-board. In either case the black-board stops exactly the same number of bundles of rays. But at noon these rays heat a small space, and in the morning or evening they heat a much larger space. This tells us that, at noon, the sun's rays are less spread out over the earth's surface than at other times of the day. At noon a bundle of rays send their heat into, say, eight square feet of ground; in the morning or evening they send their heat into, say, forty square feet of ground. Therefore, at noon each square foot of ground gets about five times more heat than it gets when the sun is shining at a great slant. At any place the angle of the sun changes every moment of the day because the earth is rotating on its axis.

But the earth also revolves round the sun. From March 22nd to September 22nd the sun shines with less slant on places north of the equator, and from September 22nd to March 22nd he shines with less slant on places south of the equator. We can, therefore, say that the amount of heat a place receives at any time depends (1) on the time of the day: (2) on the time of the year.

It is the angle of the sun's rays which explains why he gives any place more heat at one part of the day than at another, and at one part of the year than another. That would be the only reason if there were no atmosphere. But there is another reason. In the evening or early morning, even when there is no cloud, we can look at the sun for a moment or two, which we dare not do in clear noon-day. This tells us the second rèason.

Something seems to weaken the sun's force when he is low down in the sky. His rays have to fight their way through something to reach us. This something is the atmosphere. The rays have to pass through more air when he shines at a

slant than when he is overhead. Take an orange. We can imagine the fleshy part to be the earth and the skin to be the ocean of air round it. Now, if, with a needle or a knife, you pierce the skin straight downwards towards the centre of the orange, you will go through this skin by the shortest way—say one-eighth of an inch. But if you pierce the skin not straight, but slantingly, you will go through the skin by a long way—say one-quarter or even half an inch. In the same way, when the sun is at his highest point in the sky, his rays pass through the ocean of air by the shortest way: when he shines slantingly his rays pass through the ocean of air by a longer way. As a matter of fact, however, heat rays pass through the atmosphere without heating it, if the air is quite dry and pure. But the denser air near the earth's surface is full of particles of dust and water, and these absorb some of the heat rays coming from the sun. In this way the atmosphere is heated a little by these rays as they pass down through it—but only a little. If the earth's surface got no heat except the heat thus absorbed directly by the atmosphere, it would be cold. But our screen of air does much more than this. It helps us in another way. It cannot catch much heat from the sun as his rays pour down on our earth, but, once they have reached it, the screen prevents them escaping. How does it do this?

What becomes of the heat that reaches the earth? Some is reflected off it. Water, for example, reflects most of the heat rays which strike its surface. We might say it refuses to absorb heat quickly. White objects reflect heat more than dark objects. That is why, in India, we wear white cloth. It reflects a great deal of the sun's heat, and so keeps our bodies cool. For the same reason we whitewash the outer walls of our houses. People in cold countries do not do so. Some bodies, however, reflect little heat and the sun's rays are chiefly used in warming them directly. We can say the sun's heat passes into them.

But this heat does not remain there. The earth radiates into space the heat it receives, just as a lamp does, on a small

scale, and the sun does on a very large scale. If it did not do so, it would be continually getting warmer and warmer. During the day the ground absorbs more heat than it can radiate: but at night it radiates more than it absorbs and so becomes cooler. Again, some of the heat that strikes the earth is conducted beneath the surface. One particle, becoming warmed, passes on heat to its neighbours just as, when we place one end of an iron rod in the fire, the other end soon becomes warm, because the heat passes along the particles of the rod. Water, air and earth are, however, not as good conductors of heat as iron, and soil is so poor a conductor that none of the sun's heat goes far down below the surface. And the heat that is conducted beneath the surface of the earth when the sun is shining is conducted back when he has set. Now, the heat which is reflected or radiated or conducted from the earth does not escape away into space. If it did, our earth at night would be too cold for us to live on. It is caught by the screen of air surrounding the earth. This screen prevents the surface of our earth being frozen like that part of the moon on which the sun's rays are not striking.

This work is called convection. The lower layers of water, in a chatty on the fire, are heated by conduction because they are touching the hot bottom of the vessel. Cool water is heavier than warm water and, so, the cool upper layers of the water in the vessel tend to sink and push away the warm, lower layers. They take their place. This is convection. The same thing happens with the air surrounding the earth.

When the sun's heat pours down on the earth, it heats its surface. The ground feels hot when the sun shines on it. This heated surface warms the layer or bed of air lying next it. This layer, being warmed, expands, becomes lighter than the air above it and rises through it. The upper layers, being colder and denser, sink down to the ground. They are pulled down by gravity. They in turn are heated, expand, and rise. This process goes on, the warm air rising and the cooler air

sinking. One after another the different parts of the air are brought down and heated, and in this way a deep layer of air over the ground becomes heated by the rays of the sun. The longer he shines and the more vertically his rays fall, the thicker is this layer of warmed air lying over the earth, and the warmer it becomes. All this heat has come from the sun, but very little of it has come directly. Most of it has first come to the earth and has then passed into the atmosphere. Thus, whether a place is warm or cold depends on whether the air there is warm or cold. If at 8 a.m. we say the thermometer at Calcutta or Bombay or Madras stands at 76° F., what we really mean is that 76 degrees is the temperature of the air at those places. This heated air over the surface of the earth is like a warm blanket which keeps in the heat of the sun for our use. Without it, the heat coming to our earth would quickly fly back into space. At night it would rapidly disappear and the ground, having lost its heat, would be very cold, and all water would be frozen. If there were no atmosphere, all parts of the earth would lose all their heat during the night. There would be nothing to stop it from flying quickly off into space, and we should then be frozen to death. For most part of the year the temperature of places in India, say Bombay, is higher at night than the temperature of places in Scotland, say Edinburgh, during the day. The reason is, that the atmosphere at Bombay has kept in so much of the greater heat received during the day, that the temperature of the air there is greater than that of the air at Edinburgh, even though it is being heated by the sun in the sky. The temperature of any place depends, not only on the heat it gets from the sun, but on how much of it the atmosphere keeps from escaping into space.

The Temperature of the Air varies with Altitude.—This law also explains why the air is cooler the higher we go up. Air high up can only catch a little of the heat that passes down through it from the sun, and it gets very little of the heat that rises from the earth. Take a table-land 2000 feet above sea-level, say the Deccan. The sun's rays which strike places

at sea-level, such as Madras or Bombay, have to pass through 2000 feet more of air than do those which strike the table-land. And not only so ; this 2000 feet of air is much denser than the air higher up. The rays that strike the table-land, having less air to pass through, strike it more fiercely than they strike Bombay or Madras. But we must remember that dense air, though it keeps off a little of the sun's heat when the heat rays pass down through it, does much more work in keeping the heat which has reached the surface of the earth, from radiating off it. Hence the air lying over the table-land, being less dense, has very much less power to keep down the heat than the deeper and denser air at sea-level. The sun's heat is therefore radiated much more rapidly from the table-land than from land at sea-level. This radiation, too, goes on throughout the twenty-four hours, both when the sun is shining and at night. The temperature of the air at any place is the balance between the heat it receives from the sun and the heat it loses by radiation. The Deccan may receive a fiercer heat (it certainly receives a brighter light) than Bombay or Madras, but it loses a great deal more. The screen or blanket of air lying over it is less dense and shallower than the air lying over Bombay or Madras, and lets the heat escape. Hence the air on the Deccan is cooler than at places at sea-level. We say the temperature of places on the Deccan is lower than that of Bombay or Madras.

The higher we go above sea-level the cooler the air becomes. For every 300 feet we ascend the thermometer falls one degree F. The airman who flew to a height of seven miles reported that his thermometer marked 98 degrees of frost. This is a greater cold than is felt in the coldest winter on any part of the earth's surface. The very high clouds we see in the sky are composed of tiny particles of ice. On the highest ranges of the Himalayas, even though the sun is shining as brightly as on the plains, the cold is so great that the ice and snow never melt. Some of the explorers of Mount Everest had the blood in their hands and feet frozen by the intense cold. The reason is that at such a height the screen of air is so thin that

the heat which reaches these mountains from the sun rapidly flies off or radiates into space.

It is the carbonic-acid gas in the air that does most of this work of keeping the heat received from the sun from escaping from the earth. Thus, though it forms only a very small part of our air, it is most useful. If the atmosphere contained still more of this gas, it would be still warmer. If, for example, the air over the Himalayas contained double its present quantity of carbonic-acid gas, the heat retained in the atmosphere might be enough to melt all the snow and ice on these mountains.

The work done by the atmosphere in keeping back heat also explains why, at places like Darjeeling, Mahabaleswar or Ootacamund, lying thousands of feet above sea-level, the nights are much cooler than the days. After the sun has set, the heat he has poured down during the day on those places very quickly escapes through the thin screen of air, and the temperature falls rapidly. The day is hot, the night is cold. We say that in such places there is a wide *range* of temperature in the twenty-four hours. At places on a lower altitude, the nights are also cooler than the days, but the difference, or range, of temperature is not so great, because there the heat cannot escape so quickly. We can now add another rule about the heat of the air. The temperature of the air over any place, at any time, depends, as we learned before, on the angle at which the sun shines on it, *i.e.* it depends on latitude. We have now learned that this temperature also depends on the depth of air over it, *i.e.* it depends on altitude.

Air over the land heats and cools more quickly than air over the sea.—There is another thing to be remembered. The heat coming from the sun warms both the land and water of our earth. But it does not raise the temperature of both at the same rate. Land gets heated about five times as quickly as water. When the sun shines strongly, a rock or stone is sometimes too hot to touch, but we never find water raised to such a temperature as this. The sun's rays striking on a rock

or on soil cannot sink deep into it. All the strength of his rays is used up in heating a thin layer on the surface, say an inch or two. But the sun's rays falling on water penetrate much farther, and so water is heated to a greater depth than land. Water also *reflects* heat, while land does not; it therefore absorbs less of the heat of the sun's rays. Besides, some of the sun's heat is used up, not in raising the temperature of the water, but in evaporating it. Just in the same way, water gives up heat more slowly than land. After the sun has lost his full strength in the evening or when he has set, the heat he has poured into the land and sea escapes or radiates into the air; but it escapes much more quickly from the thinly heated surface of the land than from the more deeply heated surface of the sea. The sea is heated more slowly than the land, but it also cools more slowly. When we say this, we mean that the air lying over land becomes heated and cooled more quickly than the air lying over the sea.

This law, that a water surface heats and cools slowly while a land surface heats and cools rapidly, is very important. In summer a water surface, such as a lake or sea, is cool compared to the land surface near it: in winter it is comparatively warm. In places far from the equator, in the cold season, it makes a great difference to a country if it is washed by an ocean which has not lost its heat so much as the land has. A warm ocean is then like a warm blanket to that country, and a wind blowing from the ocean brings warm air over the land.

Isotherms.—In maps showing temperature certain lines, called isotherms, are drawn. A meridian is a line joining all places which have the same longitude; an isotherm is a line joining all places which have the same mean temperature at any time, say in a particular month. (Isotherm is a Greek word meaning 'equal heat.') Figs. 24 and 25 are such maps. One shows July isotherms and the other January isotherms of the world. These maps teach us quickly certain rules about the temperature of the atmosphere.

By comparing the maps we see:—

1. Temperature changes with the seasons. Trace the

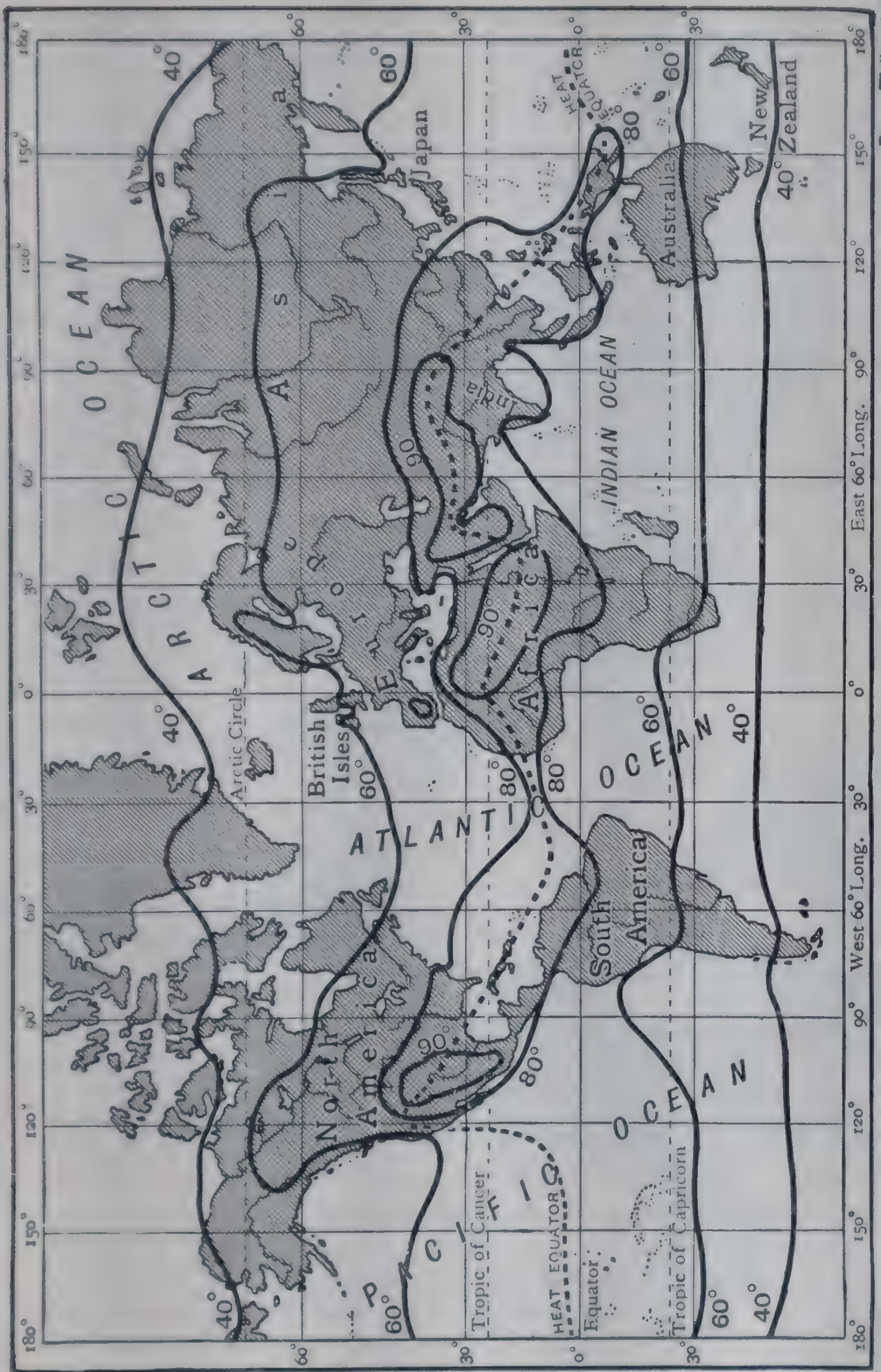


FIG. 24.—Isotherms of the world in July.

isotherm of 80° F. in July. Nearly all of it lies north of the equator, and India is inside it. The reason is that in July the sun is overhead at places north of the equator. In the

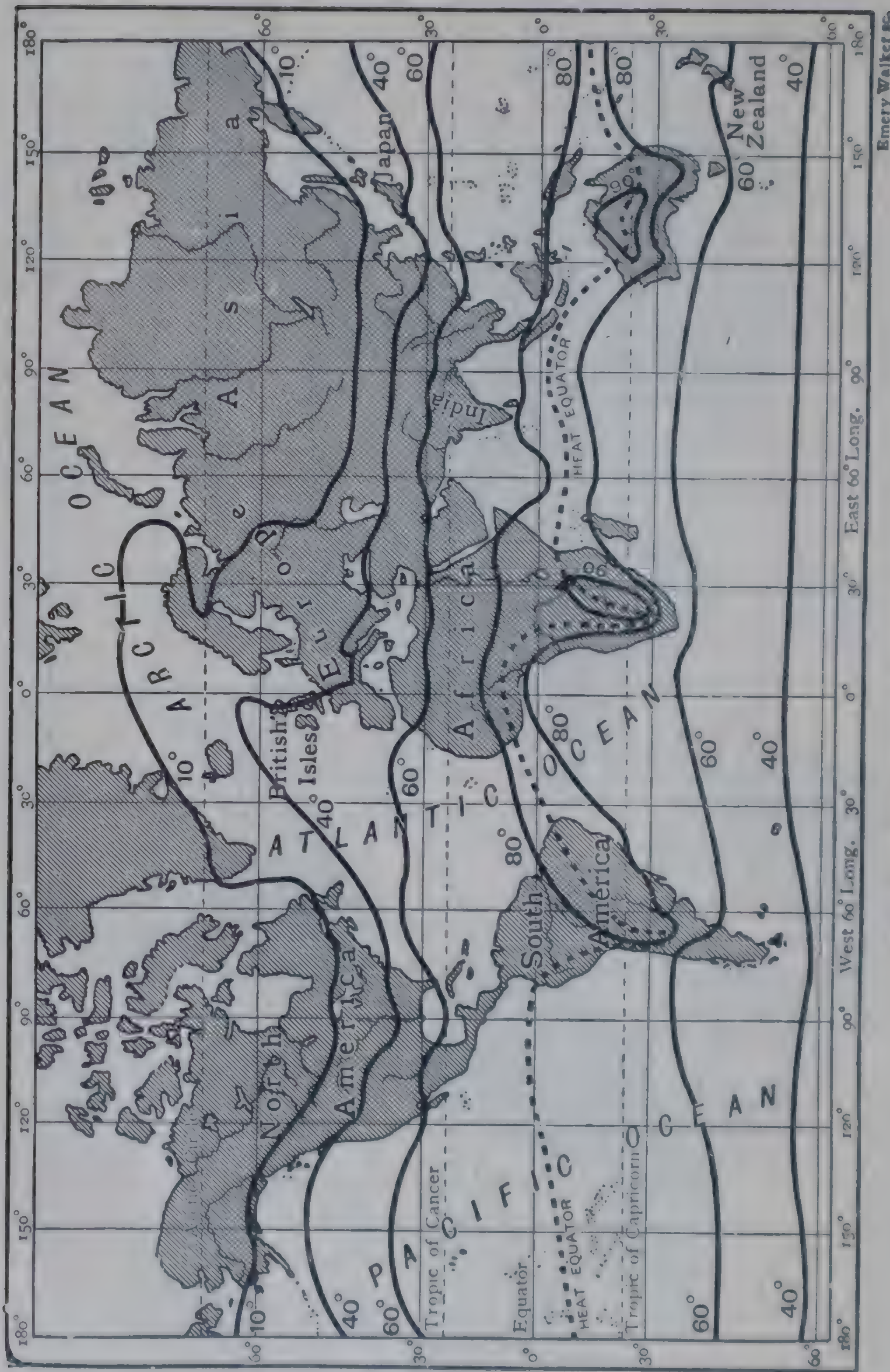


FIG. 25.—Isotherms of the world in January.

January map the isotherm of 80° F. lies almost altogether south of the equator and no part of India lies inside it. The reason is that in January the sun is overhead at places south

of the equator, and he then shines at a slant on places in the northern tropics.

2. Temperature depends on latitude. As we go farther from the equator, whether in January or July, the heat becomes less.

3. In summer the temperature is higher over the land than over the sea. In July (our summer) over no part of the ocean does the temperature rise to 90°, but we see large patches with a temperature of 90° in Asia, Africa and North America. In the same way, in January (the summer of the southern hemisphere) there are large patches of land in Australia and South Africa with a temperature of 90° F., while no part of the sea is so hot.

4. In winter the temperature is higher over the sea than over the land. In our cold season the Atlantic in 60° N. latitude is much warmer than air over any land in that latitude.

5. The range of temperature is much greater over the land than over the sea. In July, places in Tibet are very hot; they have then a mean temperature of 80°; in January this mean temperature is only 40°—a difference, or range, of 40 degrees. In July the mean temperature of the air over the Atlantic opposite Spain is between 60° and 80°—say 70°; in January it is only a little under 60°—a difference or range of only 12 or 13 degrees.

The Thermal or Heat Equator is shown in both maps by the thick dotted line. It is a line drawn through the places above which the heat of the air is greatest—*i.e.* through the hottest places. In our hot season it lies well to the north of the equator; in our cold season it lies well to the south of it. We can thus say there is a belt of heat which lies in the tropics, but which shifts a little to the north or south with the sun, at the different seasons.

The pupil should notice that these maps do not show the actual temperature in places much above sea-level. The degrees of heat are mapped as though all places were at sea-level. If, at a place 600 feet above sea-level, the thermometer

shows a temperature of 52° F. it is mapped at 54°, because (since the temperature falls one degree for every 300 feet we ascend) 54° would be its temperature were it at sea-level. Thus the maps show the temperature at the top of the Himalayas as over 80° in July and about 60° in January, while, really, the temperature there is below freezing point. 80° in July, and 60° in January are the temperatures for the region of the Himalayas if they were at sea-level.

CHAPTER VI.

THE ATMOSPHERE (Continued).

How the Atmosphere affects Moisture.—But that is not all. The ocean of air round our globe is more than a screen protecting the earth from getting too much heat from the sun, and from losing too much heat when he is shining at a slant, or after he has set. This ocean of air is also a kind of screen for moisture. It is that part of our world which contains moisture, either invisible, as water-vapour, or in the shape of clouds, mists, and rain. It does not make this moisture, but it keeps it when it is made. Water is a liquid, but when it is heated it becomes a gas which we call water-vapour. Just as by heating water in a vessel we turn it into invisible steam, so, when the sun heats water, it turns it into invisible water-vapour which mixes with the atmosphere. The atmosphere thus helps to make the earth a suitable dwelling-place for man. It is like a huge, invisible sponge, which catches the moisture sucked up by the sun from oceans, seas, lakes and rivers, and keeps it suspended over the earth. When it lets it go again, this moisture falls on the earth as dew, rain, hail and snow. What kind of life should we lead without the moisture that comes from the sky ?

Saturation : Evaporation and Condensation.—Now, the atmosphere does not take up moisture and let it go again by chance. There is an important rule we must remember. All air contains some moisture, though we cannot see it. But air can only hold a certain quantity of moisture, and the rule is this :—The higher the temperature of air, the greater is the amount of moisture (water-vapour) it can contain. The more air is heated, the more invisible vapour it can hold : the more

it is cooled, the less it can hold. Heating is the key that lets invisible water-vapour into the atmosphere ; cooling is the key that takes it out. The atmosphere is cooler and cooler the higher we go up. Air which is very high up can, therefore, hold very little moisture. About three-fourths of all the water-vapour in the air is in the lowermost two and a half miles of the air. Above the height of Mount Everest the air can hold only very little water-vapour. When air contains all the water-vapour it can hold, it is said to be saturated. But if this air be heated, it is no longer saturated because now, being warmer, it can contain more water-vapour. If, on the contrary, it is cooled, it can no longer contain the water-vapour in it, and this vapour is condensed and falls by its own weight, as rain, hail, or snow. On the other hand, when water is turned into water-vapour, we say it is evaporated. Condensation and evaporation are, therefore, the opposite of one another. We can thus see it makes a great difference to a place if the air lying over it is saturated or not. If it is saturated, it is ready to give up its moisture, and it will do so if something happens to cool it. If it is not saturated, we might say it is thirsty, for it is able to absorb more water-vapour, and it will therefore dry up pools on the ground, and, if it is very thirsty, it will parch the soil and even wither up plants and crops.

Place a lump of ice in a chatty and very soon you will see beads of moisture gathering round the outside of the vessel. The ice has cooled the air lying round the outside of the vessel, and condensed some of the invisible water-vapour in it. The ice has not put this moisture into the air : it was there before. It has cooled the air, and so made it less able to hold water-vapour, and some of it is condensed. It is just the opposite when air is heated. In the cool morning we often see moisture in the air, in the shape of mist or of thin clouds. After the sun rises and heats the air, these mists and clouds disappear. This does not mean that the moisture in the mist and clouds has been destroyed. It is still in the air, though now we cannot see it. The sun's heat has raised the temperature of

the air and made it able to hold more invisible moisture. The air was saturated before and could not hold, in the shape of water-vapour, all the moisture in it. But now, being heated, it is no longer saturated. We might say it is now thirsty, and is able to hold more water-vapour than it could hold before.

Our atmosphere is always receiving water-vapour evaporated by the sun from rivers, lakes, and oceans. When the atmosphere can hold no more, or if it is cooled, this water-vapour is condensed as cloud, mist, or fog, floating in it. If the atmosphere be still more cooled, the condensed moisture becomes liquid and falls to the earth as rain or dew: if it is cooled very much, it may fall as hail or snow. The tiny particles of dust in the air greatly help this work of condensation. They are solid and cooler than the water-vapour in which they float and they become centres round which the water-vapour clings and is condensed.

Clouds, rain, mist and fog, dew, frost, hail and snow are all children of one family. The sun is their father and water is their mother. They are forms of condensed water-vapour. This water-vapour as it rises from lakes, rivers and oceans is at first invisible, but as it passes into the cooler air higher up, it condenses and forms clouds of different kinds floating in the air. If these clouds are chilled, *e.g.* if a cold current of air meets them, the particles of moisture in them are still more condensed and form droplets. As the drops get larger, the clouds get thicker and darker, and when these drops are still larger the air cannot hold them, and they fall (*i.e.* they are pulled down by gravity) in the form of **rain**. But it sometimes happens that these rain-drops, as they fall, pass through air which is warm enough and dry enough to evaporate them before they reach the earth, and they therefore disappear as invisible vapour without falling on the ground as rain. Surely deserts need rain more than anything. But they seem to refuse to receive it. The hot air lying over them often evaporates a shower of rain falling from high clouds before it reaches the ground.

Late at night or early in the morning the ground has radiated a great deal of its heat into space. The air above it is thus cooled. It can no longer hold the invisible water-vapour in it. If there is much of this water-vapour, it condenses as **mist** or **fog**, which are really clouds resting on the earth. Looking up at a mountain, we may see it is covered with clouds. But if we climb up it, when we pass through these clouds, we call them mist or fog. Thick, yellow-coloured fogs are sometimes seen in Calcutta and other large cities. The air is there filled with smoke particles from the many chimneys in the town. Round these particles the water-vapour condenses and forms a thick yellow fog.

Whenever air containing water-vapour is cooled, it becomes saturated and mist and cloud are formed. Thus, in our hot season, when the heated air of the plains in the middle of the day rises up the sides of mountains such as Dodabetta, it is chilled, clouds are formed, and these often burst in rain. This may happen day after day. This explains why we so often see clouds on mountains. Or, if a warm current of air, full of moisture, meets a cold current, fogs are formed. Off the coast of Newfoundland a warm ocean current, the Gulf Stream, flows close to a cold current, the Labrador current. If the warm air lying over the warm current meets the cold air over the other current, its water-vapour is condensed as fog. This part of the coast is dreaded by sailors on account of its fogs. A fog often surrounds an iceberg because the air round it is chilled. Fogs are very common over lakes and rivers. In our cold season steamers on the Irrawaddy and Brahmaputra have often to stop at night owing to these fogs. The morning sun makes them disappear.

Dew is formed very much in the same way. After sunset, if the night is clear, so that the ground quickly gives up the heat it received during the day, the air above the ground becomes chilled. It can no longer hold all the water-vapour in it. This vapour is condensed, and the ground and its plants are covered with tiny drops of water which we call dew. Whether much or little dew is formed will depend on the

amount of water-vapour in the air, and on how much it is cooled. In some parts of India where little rain falls, the plants are refreshed with dew when a cold night follows a hot day. Dew does not fall like rain. It condenses on the surface of solids, just as moisture gathers on the surface of a vessel full of ice-water.

In cold countries where the temperature falls below 32° F., the air is so cold that a kind of ice-dew is formed, and the ground in the morning is covered with tiny particles of frozen water called **hoar frost** or **white frost**. Even in hot countries like India showers of frozen rain-drops, called **hail-stones**, sometimes fall. They have been frozen by falling through very cold air, but they soon melt in the warm air lying over the ground. The clouds very high up in the air are, owing to the great cold at that height, formed of tiny pieces of ice-like dust or frozen water-vapour, called **snow**. In hot countries this snow is melted into rain as it falls through the lower, warmer air. But in cold countries and on the tops of high mountains all over the world it is not melted, but falls in flakes like tiny feathers, covering everything with a soft, white coating. Nothing can be more beautiful than a snow scene, such as is sometimes seen at Simla and Darjeeling, where the ground is covered with a white mantle and where every leaf and twig glistens in its covering of snow.

The Atmosphere is a home of Moisture.—Thus we must always think of the atmosphere as a home of moisture. Sometimes we see it as clouds, fogs, rain or snow. Very often we do not see it. But it is always there. In India, even in the dry season, the air in a large school-room may contain several pounds weight of moisture. During the summer monsoon it contains perhaps twice as much. In some places the air in the rainy season is so full of moisture that everything is damp, and we have to light fires to keep things dry. Day after day the sky in India is clear, with no clouds, or only a few. We think we must wait till the winds bring us rain-clouds. But if the temperature were suddenly to fall, if the air were suddenly to be greatly cooled, mists and clouds would be seen in the

sky; if the cold grew greater, the clouds would burst in rain; if the air were still more cooled, the ground would soon be covered with snow. The air above us, full of invisible moisture, would be forced by the cold to give it up. There are instruments for measuring how much moisture air holds. Every day, from hundreds of different places in India, the rainfall, the temperature and the amount of invisible moisture in the air are telegraphed to Government observatories at Bombay, Calcutta and Madras. The Government wants this information, because it helps them to know how the crops in these places are getting on, and whether there is any chance of famine.

Even without instruments we can tell whether the air at any place is dry or contains much moisture. It is much easier to dry a wet cloth on a clear day than after rain has fallen. The reason is that on a clear day the air is not saturated, *i.e.* it is thirsty for moisture and so quickly absorbs the moisture from the cloth. After rain the air is nearly saturated; it is not thirsty for moisture and so it only takes the moisture out of the cloth very slowly. If at Agra, even on a cloudless day, we place a lump of ice in a chatty, moisture gathers on the outside of the vessel. The same thing happens if we make the experiment at Bombay. But less moisture gathers on the vessel at Agra than at Bombay. The air at Agra is drier than that at Bombay—it has less moisture to give. The reason is easy to understand. Bombay lies close to the sea, the great source of moisture: Agra is hundreds of miles away from it.

Again, everyone knows that damp rusts iron. In Arabia a naked sword can lie all night on the ground without being rusted. The air in that country is very dry. Rain hardly ever falls. Looking at the map we see there are no rivers in Arabia. There is too little moisture to give enough rain to feed rivers. The Asoka iron pillar, near Delhi, has stood for hundreds of years in the open air, and yet the letters cut on it are still quite clear. In Madras, the iron lamp-posts on the road by the beach have only been there for a few years, yet they are half-eaten away by rust. Surely this tells us that the atmosphere at Madras is much damper than at Delhi.

We must remember it makes a great difference to a country whether the air over it is dry or moist, thirsty or saturated. If it is moist and full of water-vapour, plants can draw in this moisture even though it is invisible and even though no rain falls. If, on the other hand, the air is dry and very thirsty, it takes up every drop of moisture it touches. The ground is parched, plants shrivel up and, so, few crops can be grown. That is why deserts are barren: the air lying over them is always thirsty.

The Atmosphere distributes Heat and Moisture by its Winds.—But we have still to study another kind of work done by the atmosphere. It not only holds heat and moisture but it carries them about. It does this by moving, and moving air we call wind. A very strong wind is a gale; a gentle wind is a breeze. Wind is just moving air. Without wind, the moisture evaporated from the ocean into the air would just fall back into it again, and the land would be left dry and desert. The monsoon winds, every hot season, bring to our fields millions and millions of tons of water which has been evaporated from distant parts of the Indian Ocean. The same thing happens in other parts of the world. Winds carry moisture from the sea to the land. We bless the winds that bring us rain. Other countries have to thank the winds for bringing them heat. To the British Isles the winds bring an enormous amount of heat, which they carry from hot parts of the world. Without these heat-giving winds the British Isles would be much colder than they are; they would have many fewer inhabitants, and their lives and habits would be very different from what they are. Winds bring to some countries as much heat as comes directly to them from the sun. If a wind blows from a cold, dry land, it brings neither heat nor moisture. In Northern India, in the cold season, the winds blow from the land. They are cool and dry.

The Pressure of the Atmosphere.—Now, men have found out that winds do not blow here and there by chance. There is a law of winds: there is a reason for the gentlest breeze. The heat of the sun does more than heat the air; it makes it

move. It is like a great engine that drives the winds, this way and that, over the earth's surface in currents, which we call winds. Air is different from a solid like land, or a liquid like water, because it is very elastic. It is like a spring; it can stretch out very thinly or be compressed very closely. Air has weight. Therefore the air at the surface of the earth is pressed down by all the air lying over it. It is there compressed or dense. The higher up we go, the less dense is the air. But, as the air is elastic, the more it is pressed down the more it presses up. It is elastic in all directions. It is pressed in all directions, and it presses back in all directions. This pressure becomes less, the higher we go up. The barometer is an instrument for measuring this weight or pressure of the air at any place. At sea-level the barometer shows that the pressure of air on each square inch is equal to the pressure, or weight, of a column of mercury thirty inches high. As we go up, the pressure of the air becomes less, because there is a less *depth* of air pressing on the barometer, so that the *density* of the air is less. Thus the mercury in the barometer falls as we go up. It falls one inch if the barometer is carried from sea-level to a height of 910 feet. But to cause it to fall another inch it must be carried up more than 910 feet higher. At a height of 9,330 feet it must be carried up a further 1,220 feet before it falls an additional inch. This means that a column 1,220 feet high, of the thinner air at this great height, just balances a column 910 feet high of the denser air at sea-level. At a height of about 16,000 feet, twice the height of Dodabetta, the pressure is about half that at sea-level, *i.e.* the mercury in the barometer would fall from thirty to fifteen inches. We should have to go up to a height of twenty-one miles before the mercury would stand at one inch high.

CHAPTER VII.

THE ATMOSPHERE (Continued).

Changes of Atmospheric Pressure.—The only cause that can make air move is a change of pressure. The pressure of air in a bicycle tyre is great. The pump has compressed it very much; we can feel it against our fingers, if we squeeze the tyre. If the tyre be punctured, the air rushes out. It comes from a place where the pressure is great (inside the tyre) to a place where the pressure is less (outside the tyre). If the tyre has been pumped up very much, the air rushes out through the puncture very fast; if the tyre is only pumped up a little, the air escapes more slowly. Now, this is a very important rule, or law, to remember about the air or atmosphere. Air tends to move from a place where the pressure is great to a place where the pressure is less, and the greater the difference of pressure between the two places, the faster the air moves. In observatories in India telegrams are being constantly received, telling the pressure of the air at different places, so that every day lines can be drawn on a blank map, joining all the places where the pressure is the same, and in this way it is possible to tell in which direction the wind is likely to blow over different districts. If in June it is known that the pressure at all places in India is becoming less, that means that the monsoon winds from the sea will soon be blowing. If the barometer falls very quickly in Madras, that means that a strong wind, perhaps a cyclone, will soon be blowing. At once captains of ships in the harbour are warned. They get up steam and sail out to sea, for Madras harbour is not safe for ships in a big storm. Every sea-captain has strict orders to

have a good barometer, or two, or three, on his ship. It is his greatest friend. It warns him if a storm is coming on, even though the sky is clear and the sea calm. In countries like England, where the weather changes often and quickly, many people keep barometers in their houses.

Now, changes in the pressure of air at different places are caused by changes of temperature. When heated, air expands and fills a larger space. When cooled, it contracts. These changes are accompanied by changes of pressure. If air, resting on the earth's surface, is heated, it expands, becomes lighter and rises. At once, from all sides, air at a higher pressure rushes in to take its place. This rushing air is wind. In a kitchen the fire heats the air over it and causes it to move up the chimney, and its place is taken by cooler air rushing in by the door or window. In hot deserts the ground gets quickly heated by the sun; the air lying above it also gets heated: it expands, becomes lighter and begins to rise. As the ground becomes more and more heated, the lower air gets warmer and warmer, and moves upwards. The denser air, rushing in to take its place, often raises a dust-storm. This rushing air is wind.

Land and Sea Breezes—Another simple example of how wind is caused is seen in the case of land and sea breezes. At places near the sea-coast in India and other countries, the heat of the sun causes these local winds. From early morning the blazing sun pours down his heat on land and sea. The land being heated much faster than the sea, the air over the land is also heated more quickly than the air over the sea. By noon, or a little later, the air over the land is very much hotter than that over the sea. It therefore expands, becomes lighter and rises, and denser air from the sea rushes in to take its place. We call this rushing air the cool sea breeze. At night the land and the sea both become cooler. But the land cools faster than the sea, and so the air over the land also cools much faster than that over the sea. Hence the cooler and denser air from the land rushes seawards to take the place of the warmer air over the sea. This wind is called the land

breeze. In cloudy weather, however, land and sea breezes are not so regular nor so easily noticed, because the clouds prevent the land and sea surfaces from being heated to different degrees. Again, if the monsoon or a storm is blowing, land and sea breezes do not take place. Along some coasts these land and sea breezes are so regular that the fishermen put to sea with the land breeze and return to shore with the sea breeze.

WORLD WINDS.*

The Trades.—Land and sea breezes are only local winds. They blow out from the land and in from the sea for only a short distance. But there are winds which blow regularly over wide areas of the surface of the globe. They obey the

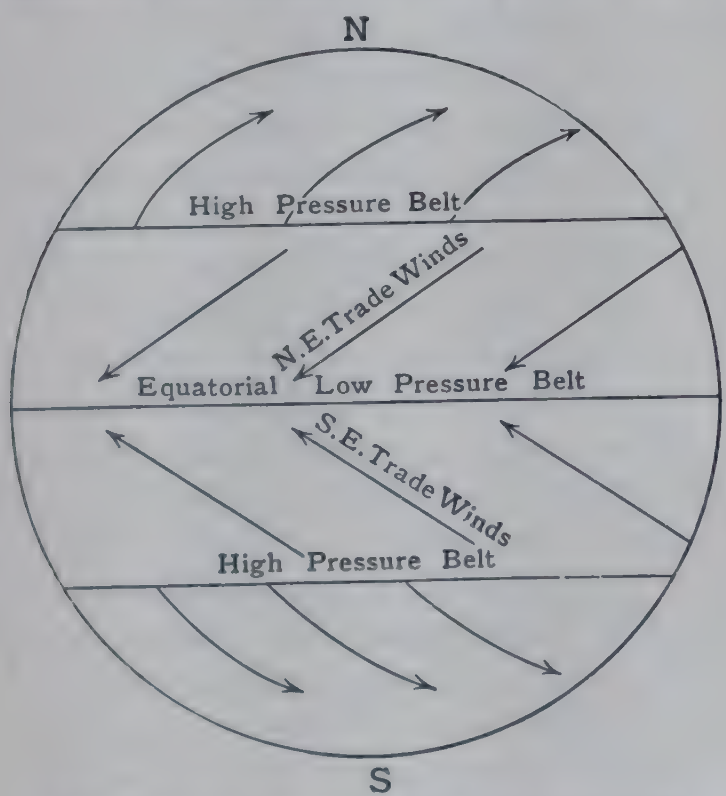


FIG. 26.—How the main winds of the world blow.

great law of winds, blowing from places where the pressure is high to places where the pressure is low. Fig. 26 shows the parts of our globe where pressure is regularly high and where it is regularly low. We must remember where these areas are.

* Study carefully the coloured maps of rainfall and winds at p. 80.

These places, or belts of high and of low pressure, are not where they are by chance. There are reasons why they lie in those places, but these reasons are too difficult to explain in this book. It is, however, easy to understand why the belt at the equator is a belt of low pressure. This is the hottest part of the globe, for here the sun's rays fall straight or nearly straight down all the year round. The air over this belt is, therefore, always being heated. As it gets heated, it expands and rises. To take its place air comes along the surface from the high-pressure belts to the north and south. Hence, there are always steady and regular winds blowing towards the equator, from either side. We might expect them to blow from north and south. But, owing to the rotation of the earth, these winds are deflected. The rule is that, owing to the earth's rotation, in the northern hemisphere, a wind, whether blowing towards the equator or the pole, is deflected to the right of the direction it would take, were the earth at rest. In the southern hemisphere, a wind blowing towards the equator or the pole, is deflected to the left. In consequence, the steady winds blowing towards the equator in the northern hemisphere become north-east winds; in the southern hemisphere they become south-east winds. (The direction of a wind is that *from* which it blows: the direction of a sea-current is the direction *to* which it flows.) These winds in the day of sailing ships were very useful to navigation because they are regular and steady, and so sailors called them Trades—the north-east and the south-east Trades. They are the most important winds of the world.

The Westerlies.—Winds also blow polewards from the high-pressure belts. But, owing to the rotation of the earth, they are deflected to the right in the northern hemisphere, and to the left in the southern hemisphere. They thus become south-west and westerly winds in the northern hemisphere, and north-west and westerly winds in the southern hemisphere. Thus, in both hemispheres there is a westerly swirl of wind round the poles. In the southern hemisphere these winds are steadier than they are in the northern hemisphere, because, as the world-map shows, there is no land, or very little, to check them.

Here they are called by sailors the Brave West Winds. As they blow in about the latitude of 40° S., they are also sometimes called the Roaring Forties.

The equatorial low-pressure belt and the high-pressure belts in the north and south are regions of calms. In the equatorial belt the air is rising, not blowing along the surface, and so the sea there is usually calm. Sailors called this belt the Doldrums, or sleepy places, because their ships here got no wind to fill their sails, and were often becalmed for days and weeks. The high-pressure belts are also regions of calms, because here the winds blow out over the surface. To take their place the air from above falls to the surface. They are regions of falling air, just as the equatorial belt is a region of rising air, and the sea in both regions is usually calm, or stirred only by variable breezes. Sailors have given the name of Horse Latitudes to these regions.

Thus, we have a system of regular world winds: (1) the steady north-east and south-east trades, blowing from the horse latitudes towards the doldrums or hot equatorial belt; (2) the south-west and west winds in the northern hemisphere, swirling round the north pole, and the north-west and west winds in the southern hemisphere, swirling round the south pole. There is one point to notice about these great winds—they shift a little according to the time of the year. The equatorial hot belt of low pressure is, from March 22nd to September 22nd, a little to the north of the true equator, because the sun is then shining vertically in the northern tropics. In consequence, the south-east trades in that part of the year blow a little beyond the true equator, and the north-east trades stop a little short of it. Also, the westerlies of both hemispheres keep a little farther to the north. From September 22nd to March 22nd, the equatorial hot belt lies a little to the south of the true equator, the sun being then vertical in the southern tropics. At this season the north-east trades blow a little nearer the true equator, and the south-east trades stop a little short of it, while the westerlies of both hemispheres keep a little farther south. If we compare a

map of the world winds for July with one for January, we can see this change clearly. Any rotating planet with an atmosphere would have a system of winds of this kind. Hence the trades and westerlies are sometimes called planetary winds.

Seasonal Winds—The Monsoons.—Now, if the whole globe were covered by ocean, these planetary winds (the trades and westerlies) would blow regularly and steadily all the year round, shifting a little to the north or south, with the swing of the hot equatorial belt. But a large part of the earth's surface is made up of land, and as land heats and cools more quickly than water, we have other important winds. Just as there are local sea and land breezes, owing to the unequal heating and cooling of land and water, by day and night, near the coast, so, on a very large scale, we have strong winds due to the unequal heating and cooling of continents and oceans during hot and cold seasons. These winds are called seasonal or periodical winds. In India we call them monsoons from the Arabic word *mausim*, meaning a season.

The map shows that the Indian Ocean differs from the Atlantic and the Pacific, in having a vast continent to the north, just outside the tropics. In the Atlantic the great shoulder of West Africa lies north of the Gulf of Guinea; in the Pacific a small part of land lies to the north of the Gulf of Panama; and the continent of Australia (the northern part of it) lies to the south of the part of the ocean which contains the East Indies. These are the parts of the world where seasonal or monsoon winds blow. It is in the Indian Ocean, however, with its great mass of land surface to the north, that monsoons are most marked.

The Monsoons in Asia.—In June and July the sun is almost overhead for places on and near the Tropic of Cancer. The great continent of Asia then becomes very greatly heated, and, owing to the expansion and rising of the air, the southern half of the continent is a region of low pressure. The ocean to the south is then an area of high pressure. As a result there is a flow of air from the ocean to the continent. We should expect the general direction of this wind to be northward.

but, owing to the rotation of the earth, it is deflected to the right and becomes in India a south-west wind. Arabia thus gets very little of it, and Baluchistan none. One branch blows across the Arabian Sea and strikes the west coast: the other branch blows up the Bay of Bengal and strikes the coast of Burma. We study the details of this monsoon when we deal with India. In December and January the sun is overhead for places on or near the Tropic of Capricorn. The hot belt is now south of the equator. At this season the area of low pressure lies over the belt of the Indian Ocean between Madagascar and North Australia. The region of highest pressure is now the central Asiatic table-land. Thus air moves along the surface from the continent to the sea. The flow of air is deflected to its right and becomes a steady north-east wind or monsoon. We call it the winter monsoon. In the Pacific Ocean very much the same thing takes place.

In our hot season the low-pressure area over Asia draws in winds from this ocean. It is here a steady south-east monsoon, blowing on the south-east part of Asia, including Siam, Cochin-China, China, and the main Japan Islands. In our cold season the wind is here, as in India, reversed, and becomes a north-west monsoon blowing from the continent to the ocean. Here it joins the north-east trades (Figs. 31 and 32).

The Monsoon in Northern Australia.—Northern Australia is, for similar reasons, a monsoon area; only, as it lies south of the equator, its seasonal winds are the opposite of ours. In our hot season, when the sun is vertical on and near the Tropic of Cancer, the land mass of Australia has its cool season, and is then an area of high pressure, and the winds blow out from it towards the equator. But, being still south of the equator, they are deflected to the left and become south-east monsoon winds. In our cold season, on the contrary, the land mass of Australia becomes heated and is an area of low pressure and winds blow into it from the equator, being deflected to the left and becoming a north-west monsoon. We study the winds of the world more in detail when we come to the rainfall of the world.

CHAPTER VIII

CLIMATE.

I. THE CLIMATE OF INDIA.

Climate and Weather.—Having learned some of the ways in which heat and moisture are distributed through the atmosphere, we can now understand the chief factors or conditions of climate. Climate is not the same as weather. Weather means the state of the atmosphere, wet or dry, warm or cool, at any particular time, say a day or a week. Climate means the whole of the weather usually and regularly met with at each season. We can only tell the climate of a place by watching and noting the weather there for many years, say twenty, or, better still, for fifty or one hundred years. In Bombay or Madras, Karachi or Delhi, the weather may happen to be wet for a day or two in January in one year, but the climate for that month of these places is very dry, because very little rain falls there on the average of many years. In the same way, we can say a man is healthy though he may happen to be sick on a particular day. In describing the climate of a place we only consider those conditions of weather which are commonly and regularly met with. We can understand the factors of climate by first studying those of India.

In India, Government Officers study the climate of India in observatories and note and register daily changes in the weather. Thermometers, barometers, rain-gauges, and wind-gauges are some of the instruments they use, and they publish maps, or weather charts, showing changes in the weather.

THE FACTORS OF CLIMATE.

1. **Latitude or Distance from the Equator.**—An important law we have learned tells us that the farther any place is from the equator, the less heat it receives from the sun. The whole of the peninsula part of India lies in the tropics, and very little of it lies north of the Tropic of Cancer. Even Srinagar, in the north of Kashmir, is only 34 degrees north of the equator. Hence, we can say that India is a very hot part of the world, and, on the whole, the average temperature becomes less as we go north. Thus Trichinopoly, in the south of the peninsula, has an average temperature, counting nights as well as days, of 82° F., Bombay, half-way north, of under 80°, and Karachi, still farther north, of 77°, while Srinagar, at the extreme north, has an average temperature of only 53°. (This low average temperature of Srinagar is partly due, however, to its height, 5000 feet above sea-level.) When we speak of the temperature of a place, we always mean the temperature of the air in the shade.

2. **Nearness to Sea.**—Another law we learned says that the air over water heats slowly and cools slowly, while the air over land heats and cools quickly. In this way the sea equalises coastal temperatures all over the world. It helps to cool the land near it when that land is being heated by the sun, and it warms the land near it when that land is being cooled. Land near the coast, or rather the air over this land, thus becomes heated and cooled more slowly than air lying over land which is far from the sea. In May and June, when the sun is every day rising higher and higher in the sky, and heating the surface of India, Karachi is cooler than Lucknow (though Lucknow is further north), because it has the cooler air over the sea near it, while Lucknow is surrounded by hotter air lying over the land. For the same reason Karachi, in June, is cooler than Jodhpur or Bikaner. So, too, Madras, in May, is cooler than Bellary. In January, when the sun is shining at a slant on the whole of India, the air over the land has cooled faster than the air over the sea. Places on the

coast will, therefore, be warmer then than other places, in the same latitude, which lie far inland. The air in Madras will then not be so cool as that at Salem, nor the air at Karachi so cool as that at Udaipur. In that month Delhi will be colder than Bombay, partly because it is farther north and lies under a more slanting sun, but chiefly because it is far away from the warming influence of the sea. None of the warmer air over the Arabian Sea can reach it. The wind, too, is then blowing towards the sea, not from it.

We say there is a greater difference, or *range*, of yearly temperature at places inland than at places near the sea. Thus, at Delhi the average June temperature, counting days and nights, is over 92 degrees, while the average January temperature is only about 57 degrees—a difference, or range, of 34 degrees. At Lucknow, this difference is over 31 degrees. At Karachi, however, the average June temperature is about 86 degrees, and that of January 65 degrees—a difference of only 21. Islands have an equable climate. If we lived on the Laccadives, we should find very little difference between the hot weather months and the cool weather months. This difference between summer and winter temperatures is very marked in other parts of the world. In the British Isles the rivers never freeze in winter. In Russia, most of which is far from the ocean, all the rivers freeze for several weeks. Moscow, in the centre of Russia, is in the same latitude as Edinburgh, which is quite close to the sea. The range of temperature between summer and winter in Edinburgh is less than 20 degrees; at Moscow this range is over 40 degrees. In Moscow the heat in July is sometimes as great as that in Bombay, but for five months in the year the average temperature there is below freezing point. For many weeks the ground is frozen and covered with snow, and no ploughing can be done.

3. **Altitude.**—The higher we go, the cooler does the air become. In India, as in other parts of the world, the plains are warmer than the table-lands, and the table-lands than the mountains. On the highest slopes of the Himalayas, though the sun is shining brightly, the air is not warm enough to melt

the snow and ice. On the Nilgiri Hills people, even in the hot season, burn fires in their houses at night to keep warm. The coolness of hills is the reason why those who wish to escape the heat of the plains in the hot season go up to hill-stations such as Mahabaleswar, Simla, Darjeeling or Ootacamund. The average temperature of Madras and Rangoon, which are close to sea-level, is about 80° F. That of Darjeeling and Ootacamund, which are more than 7000 feet higher, is under 60°. In 1922, the climbers of the Mount Everest expedition reached a height of 27,235 feet. In 1924 they climbed even higher. The cold there was so great that the blood in their hands and feet froze.

4. **Prevailing Winds.**—The climate of a country depends on its prevailing winds, because they bring hot or cold, damp or dry air. In the northern hemisphere, if these winds blow from the north, they bring cool air, if from the south, warm air. In January, when the wind blows from the snow-fields of the Himalayas, the air at Delhi or Agra is very cold during the day, and at night it is sometimes cold enough to freeze water. A wind coming from the Thar desert is dry and hot. If winds blow from the land, they are generally dry, if from the sea (the chief source of moisture), they are damp and cool. At Bombay in July, when the monsoon is blowing from the sea, the air is very damp, for twenty-four inches of rain fall in that month: in January when the winter, or dry, monsoon is blowing from the land, the air is much drier, and scarcely any rain falls then. If winds from the sea do not reach a country, it will be barren. Afghanistan and Persia receive no such winds and, so, very little rain falls there and few crops can be grown.

The Monsoons*—The South-West or Summer Monsoon.—Monsoon winds prevail over India at different seasons. India, more than any other part of the world, depends on the rain-bearing south-west winds, which prevail from about the end of May to the end of September. Those winds bring us about ninety per cent. of all the rain that falls in India. If this monsoon fails, or is weak in any year, the crops cannot grow,

* See Fig. 68a for Annual Rainfall of India.

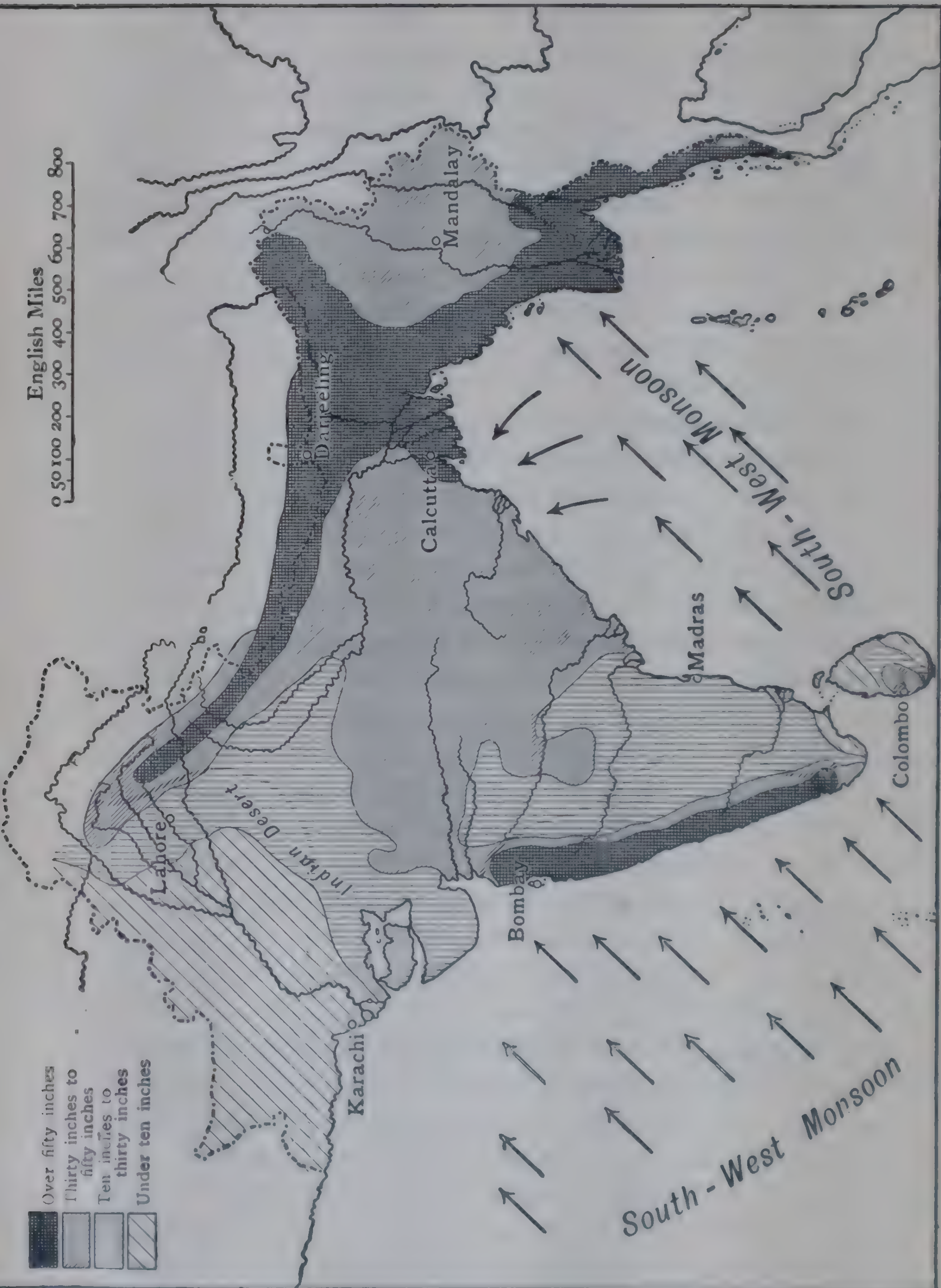


FIG. 27.—Map showing winds and rainfall in June-July (Summer Monsoon) over part of the Monsoon Lands (Indian Empire).

and people and cattle have little food to eat. If they fail for a second year, famine may come over the country. If there were no such monsoon winds, India would be a riverless desert like Persia or Arabia.

By the end of May, when the sun shines overhead north of the equator, the temperature of the air lying over the north-west of India has rapidly risen, and its pressure has fallen. A strong indraught of air sets into this low-pressure area. The south-east trades blowing across the Indian Ocean are deflected to the right and strengthen this indraught. The front of the advancing air current is always an area of very disturbed weather, with strong winds and frequent storms and cyclones. As this monsoon blows over thousands of miles of warm ocean, it is full of moisture. Part of this monsoon is diverted to the mountains of Abyssinia, which receive a heavy rainfall and feed rivers which swell the Nile floods from May to September.

The Branches of the South-West Monsoon.—The main monsoon strikes India in two currents—the Arabian Sea branch (which is much the larger) and the Bay of Bengal branch. Of the Arabian Sea branch Arabia gets very little, for the wind blows eastwards, parallel to its coast. Persia, Baluchistan and Afghanistan are out of its range and are, therefore, very dry. This branch crosses the west coast of India and gives rain to the peninsula, the Central Provinces and Rajputana.

The Bay of Bengal branch passes across Ceylon, strikes the coast of Burma and passes up the delta and valley of the Irrawaddy, giving frequent and plentiful rain to the whole country. At the head of the Bay it becomes a south-east monsoon, and crosses the coast in a broad belt towards the Himalayas.

5. **The Direction of Mountain Ranges** also makes a great difference to the climate of a country, for they turn or check winds. If the line of mountains faces the moisture-laden winds from the sea, these winds are forced to climb them; they ascend to a cooler region and cool as they ascend. The

vapour they carry is quickly condensed and falls as heavy rain. Thus, the south-west monsoon wind, coming from the Indian Ocean, strikes the line of the Western Ghats almost at right angles. The water-vapour it holds is rapidly condensed and falls as torrents of rain. During the four or five months, May, June, July, August and September, when this wind blows, over 100 inches of rain on an average falls on these Ghats and on the coast-strip between them and the sea.* After the wind has crossed these Ghats, it has lost most of its moisture. In descending to the lower level on the inland side, it becomes warmed again and can now easily hold all its moisture. Therefore, inland from the Ghats the rainfall is only about a quarter of what it is on the seaward side. During the monsoon months Mangalore receives over 100 inches and Bellary less than eight. Sholapur, Poona and Ahmadnagar also lie behind the rain-screen of the Ghats. To the south of these places there is a gap in the Western Ghats, about sixteen miles wide, called the Palghat Gap. Through this opening the monsoon winds blow clouds which, like a great flag, stretch for miles inland. At the northern end of the Western Ghats, again, the valleys of the Narbada and Tapti come down to the coast. Up these valleys the monsoon winds rush and give good rain far inland. Thus during these months Jubbulpore receives over fifty inches, though it is 500 miles from the sea.

Still further north, however, between the Gulf of Cambay and Karachi no mountains rise to check the monsoon. Instead, there is a hot, flat plain stretching right up to the foot of the Himalayas. The winds reaching this part of the coast, instead of being cooled are therefore heated, they rise, and rush high across the land, shedding but little rain till they reach these mountains. There, as in the case of the Ghats, they dash themselves against the slopes in torrents of rain. It is curious that so much moisture should pass over the Thar

* During June and July, 1924, more than 100 inches of rain fell on the Malabar coast, causing great floods such as had never been seen there before.

desert and so little fall on it. It is the desert's own fault. It heats the monsoon winds as they pass and sends them higher. Sind and the plain of the Indus are the driest parts of India, for the monsoon is deflected past them to the right, owing to the earth's rotation, and the mountains to the west prevent rain coming from that direction. The map shows that no rivers rise in this part of India, which is a proof of how little rain falls there. During the monsoon months Bombay receives more than sixty inches, but Multan less than five and Hyderabad (Sind) less than six. More rain often falls in an hour or two in Bombay than Jacobabad receives in a whole year. The map shows, however, that the end of the Aravalli Hills faces the monsoon wind in this tract, and here, therefore, we should expect more rain. Mount Abu (4000 feet) receives over fifty inches in the monsoon months. This shows that the Thar Desert is dry, not because no moisture is carried over it, but because there are there no mountains to catch it, cool it and condense it into rain. The Aravalli Hills divide Rajputana into two regions—a dry, riverless desert on the west and a less dry region on the east, watered by the Chambal and its feeders.

Mountains and high land act on the Bay of Bengal branch of the monsoon in the same way. It sweeps over Ceylon and gives heavy rain on the south-west part of the island where it is checked by the mountains. Very much less falls on the low and flat northern half. Crossing the Bay, it strikes the mountains on the coast of Burma (the Tenasserim and Arakan Yomas). These mountains and the coast strip between them and the sea are the wettest parts of the Indian Empire. The delta and lower valley of the Irrawaddy also receive heavy rain, and this river rises 20 or 30 feet. Rangoon has a rainfall during this season, of over seventy inches. Behind the Arakan Yomas, however, lies the dry zone of Burma. We might call it the Burmese Deccan. The monsoon wind in crossing this range has dropped most of its moisture and has little left to give to the country behind it. Between the beginning of May and the end of September, Mandalay, which lies in this zone, receives only about twenty-five inches.

These Arakan Yomas deflect part of the monsoon winds as they advance up the Bay so that, by the time they reach the head of it, they are blowing from the south-east and south. They cross the coast between Chittagong and the mouth of the Mahanadi. In front of them lie the Assam Hills and Eastern Himalayas. Mounting these hills they are forced suddenly upwards to a height of 5000 feet, and rapidly cooled. Here, at Cherrapungi, the heaviest rainfall of the world occurs, the average being no less than 458 inches.

Beyond these hills the monsoon is checked by the lofty barrier of the Himalayas. Here it splits into two. One branch rushes up the Brahmaputra valley which is, therefore, one of the wettest regions in India and the floods of the river are very deep. The other branch of the current blows up the broad Gangetic valley. It is very important, for it brings rain to the most fertile and most thickly peopled parts of India. We may notice certain things about it.

1. As it is turned up the valley by the Himalayas, it becomes, in this part of India, a south-east monsoon. 2. Very little of it gets beyond this great barrier of mountains. Hill stations on their southern slopes get plenty of rain. Simla during the monsoon months gets over 50 inches. But places on the farther side get very little. The tableland of Tibet is almost rainless. A few shepherds wander about with their flocks in search of pasture. Leh, in the Indus valley, behind the main ranges, receives but little more than one inch from this monsoon. 3. The air current gets weaker and weaker as it drops its moisture and passes up the plain. Thus, during this season, Dacca at the eastern end receives about 50 inches, Benares and Allahabad about 34, Lahore 15, while Peshawur, away at the western end, gets only $4\frac{1}{2}$ inches. 4. The monsoon gives more rain on its northern side, where it hugs the mountains, than on the south. Bareilly at this season is wetter than Agra.

Importance of the Himalayas.—We thus see how important the Himalayas are. They prevent both branches of the monsoon, from the Arabian Sea and the Bay of Bengal, from

passing out of India altogether. They check the air currents and force them to give up almost every drop of their moisture. The rainfall in this great plain is regularly distributed. In the first place, the monsoon ascends only a gentle slope from the Ganges delta up to, say, the Jumna. It therefore gives up its rain not all at once but gradually. Secondly, it meets the Himalayas not face to face but sideways: it is only checked and deflected, not stopped. The Western Ghats, on the other hand, meet the monsoon face to face so that it is almost emptied of moisture before it has gone more than a few miles inland. Most of the rain here falls on their seaward side and flows by short useless rivers back into the sea. It is said that about one-sixth of the total rainfall of India is thus lost on this slope. The Indo-Gangetic plain is the most important part of India because it is the most fertile, and it is the most fertile because, on the average, it gets a good and regular rainfall and because the Himalayas are a great storehouse of water (rain and snow) which, long after the monsoon is over, keeps its rivers and canals and wells well supplied with water to irrigate its fields and for thousands of years has sent down by these rivers vast quantities of fine mud to renew the soil of these fields. If India lay behind the Himalayas instead of in front of them, it would be a very different country to live in.

But that is only part of the good work of the Himalayas. They also keep off the cold dry winds which blow over Tibet and make it almost barren. It is owing to this protection that the northern plains of India have a warmer climate during our winter months than the plains of China in the same latitude, because the latter are not sheltered from the cold north wind. Some years ago, Sikh soldiers from the Punjab were sent to help other nations to restore peace to China. It was the cold season and they were encamped on the banks of the Grand Canal. In order to get water to cook their meals, they had to break off and melt pieces of the ice which covered this canal. And, yet, they were not farther from the equator than they were when at home. If any of the canals of the Five Rivers of the Punjab were to freeze, people there would think the end

of the world had come! There is another thing. Central Asia is gradually becoming drier, the rivers are shallower and shorter than they used to be, less snow and less rain falls, fewer crops can be grown, cities which years ago were busy and flourishing are now deserted and half-buried in sand. If it were not for the Himalayas, probably the same thing would happen in India. Some people think that as these mountains were gradually raised up they shut out more and more moisture from passing over them and so made the countries behind them drier and drier.

We can truly say that without these magnificent mountains India would be quite a different land. No wonder the Home of Snow has always been looked on as sacred by the peoples of Hindustan.

The North-East Monsoon.—The prevailing winds in India during the last three months of the year and in January blow from the land and are therefore dry winds. By the end of September the sun is no longer vertical over India, but over the equator, and the pressure of air in Northern India and Burma has increased. The consequence is that the monsoon winds cease to blow into Northern India. They now begin to retreat or blow in the opposite direction and the prevailing wind in the Indo-Gangetic plain is therefore from the north-west and is a dry wind. The summer monsoon is, however, still blowing into the Bay by the end of September, but it cannot get farther owing to the high pressure farther north. It therefore turns round and sweeps in from a north-easterly direction and strikes the southern end of the peninsula and Ceylon. This winter monsoon gives rain to the districts north and south of Madras, which receive most of their annual rainfall from October to December. Madras itself gets three-fourths of its rain in the last four months of the year. This rain passes inland, becoming less and less as it goes, but where it meets the Eastern and Western Ghats it is heavier. Thus Bangalore and Bellary get as much rain from this monsoon as they get from the summer monsoon blowing over the Western Ghats. Ceylon, lying in the track of both monsoons, gets plenty of rain.

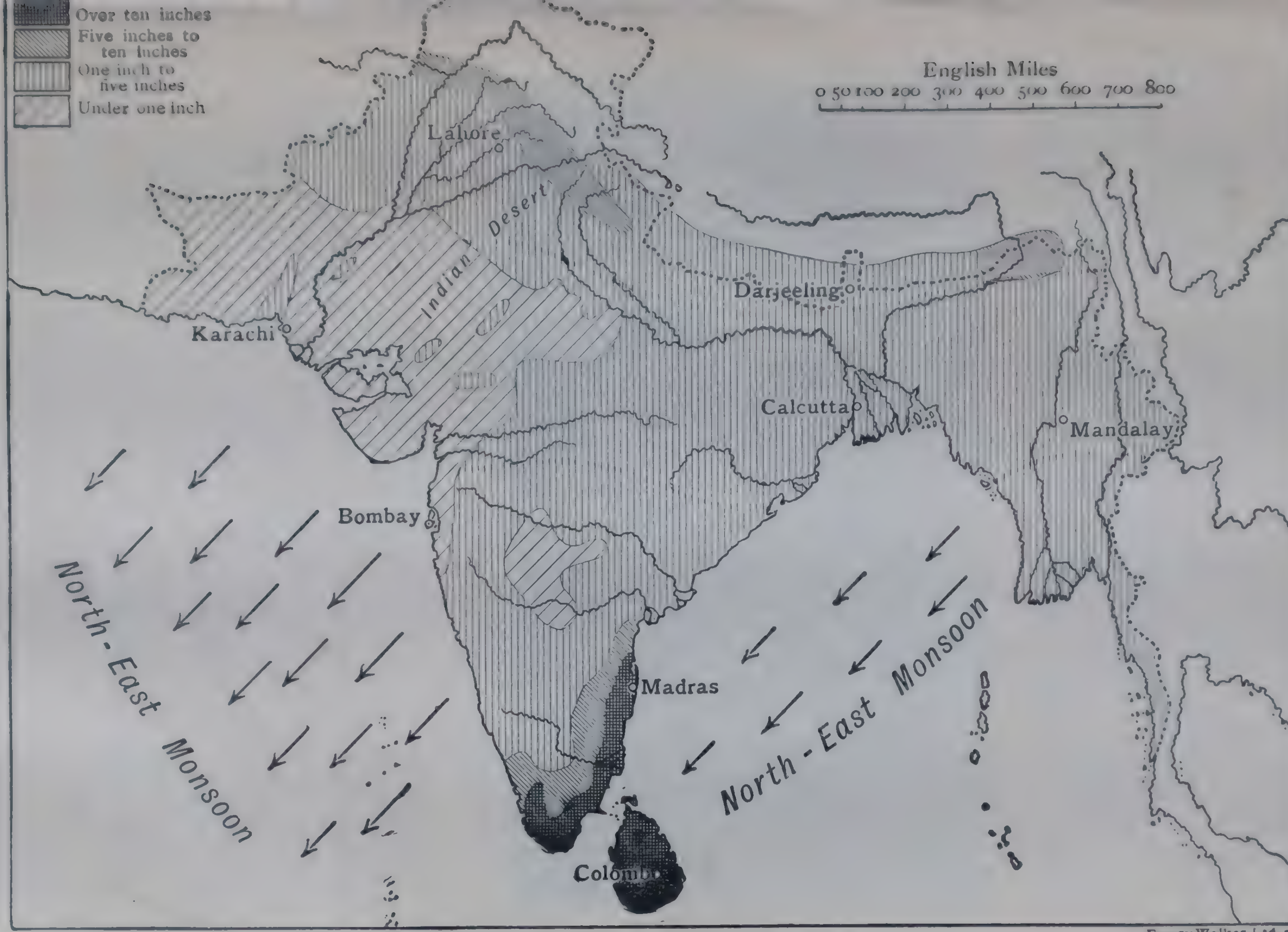


FIG. 28.—Map showing winds and rainfall of December-January (Winter Monsoon) over part of the Monsoon Lands (Indian Empire).

NOTE.—This map shows the rainfall during only two months of this monsoon.

From May till the end of January showers fall almost every day, on some part or other of the island.

By the beginning of January the north-east monsoon is blowing steadily over India, the Bay of Bengal and the Arabian Sea. Clear skies, fine weather, dry air and light winds then prevail. The wind blows from the west down the Gangetic valley, but all over the peninsula and the Bay of Bengal it is from the north-east. Unlike the south-west

FIG. 29.—Lands in China made barren by the cutting down of forests.

monsoon, the air currents now blow from the land and are dry, except where they have passed over some extent of sea. There is hardly a place in India outside the Himalayas which receives so much as one inch of rain during January, February, March or April. During April and May temperature increases throughout India and pressure diminishes, and by the end of that period the south-west monsoon begins once more to advance from the Arabian Sea and up the Bay of Bengal.

6. **The Nature of the Soil** is another factor of climate. Sand is the opposite of water, being very quickly heated and quickly cooled. Thus, in the lower parts of the Indus valley and in the Thar Desert, the sun beating on the sandy soil makes the day very hot. But at night the air very quickly cools as the

sandy soil rapidly radiates the heat received during the day, and the temperature may fall low enough to freeze water. The same thing happens in the other deserts of the earth. We say there is a great range of daily temperature in such places. The more water a soil can retain the less rapidly it heats or cools. An alluvial soil like that of the Ganges valley retains the rain, for it can sink deep into it. On rocky soil the rainfall runs quickly off the surface and is lost. Large parts of the Deccan tableland are rocky so that the rainfall quickly disappears into the rivers. It has been found that if the forests of a country are allowed to be burned and cut down, the soil can no longer retain the moisture given to it by rain and dew. Forests and jungles are like sponges which retain moisture in the soil: they therefore prevent the air being rapidly heated during the day and quickly cooled by night. They help to equalise climate. If the old irrigation canals of the Tigris and Euphrates were restored, many more plants would grow and the climate of the desert of Mesopotamia would gradually become a little cooler and damper. The climate of Sind has been improved by irrigation canals.

India is part of the world, and its climate is a part of world climate. The pupil should, therefore, study the coloured maps of Rainfall and Winds, and Figs. 33 and 33a, 24 and 25.

CHAPTER IX.

CLIMATE.

II. WORLD CLIMATE.

(See Coloured Maps of Winds and Rainfall.)

WE have now learned something about the climate of India. This means we have learned about the heat and the cold, the dampness and dryness of different parts of India, and why some places are hotter or colder, damper or drier than other places at the same time of the year, or at different times. Next, let us take these rules and see if, by their help, we can learn about the climate of the whole world.

Latitude or Distance from the Equator.—This rule holds good all over the world: it is the most important law of climate. Countries in the Tropics have a hot climate. The seas round the poles are full of ice. But we must state the law more carefully. We do not get heat from the equator but from the sun. If the sun at noon always shone overhead at the equator, then the rule would be exactly true. But we know the sun between March 22nd and September 22nd is shining north of the equator: during the other half of the year he is shining to the south of it. This means that the heat belt of the world changes; it swings north and south of the equator. We can see this by studying the maps showing the temperature of the world in January and July.* The figures on the lines of the map show average temperature in degrees Fahrenheit. We see that in our hot season the hot belt of 80° F. covers nearly the whole of the southern half of Eurasia, the whole of North Africa, and a large part of the southern half of North America.

* See Figs. 24 and 25.

In our cold season (January), this belt has moved south and no land north of the Tropic of Cancer now lies within it. Again, in the southern hemisphere, in our hot season, scarcely any places south of the Tropic of Capricorn have an average temperature of 80 degrees, but in our cold season the heat belt has swung south and covers all the land parts except the southern coasts of Australia, New Zealand and the southern end of South America.

FIG. 30.—The ice on the coasts of the land round the South Pole. A ship frozen in the ice.

Nearness to Sea.—Places far from the sea are hotter in the hot season and cooler in the cold season than places near the sea in the same latitude. The temperature map shows this. Point out places in Eurasia, North America, and Africa, far from the sea which, in our hot season, are hotter than places on the coast in the same latitude: and places in Eurasia and North America, far from the sea which, in our cold season, are cooler than places on the coast in the same latitude.

Though it is the farthest point from the equator and though the sun there never rises high in the sky, the north pole is not the coldest place on the earth. The reason is that it lies in the middle of an ocean. In the winter season some parts of the land inland from the Arctic Ocean in North America and Asia have greater cold than the north pole.

Altitude.—The higher we go above sea-level, the colder does the air become. This rule holds true all over the world. Of course it does not mean that, if we climb 6000 feet up the Andes at the equator, the temperature there is lower than if we climb only 4000 feet up the Alps in Europe. We must remember our first rule of climate.

Prevailing Winds.—Study carefully the coloured maps of winds and rainfall. The chief winds are the north-east trades, the monsoons, and the steady westerly and south-westerly winds in the northern hemisphere; and the south-east trades, the north-west and south-east monsoons and the strong and steady westerly winds in the southern hemisphere. Notice carefully that, as the heat belt moves north or south of the equator, these winds alter. When the heat belt is north of the equator, the south-east trades and westerlies of the southern hemisphere blow a little farther north than they do during the other half of the year, and so do the north-east trades and westerlies of the northern hemisphere. When the heat belt moves south, these winds shift a little south too. The monsoons blow in one direction in July and in the opposite direction in January.

Let us now see how these winds bring rain.

1. **The North-East Trades.**—As these winds blow from colder to warmer regions, they do not give up but take up moisture. But where they blow *on to* the eastern coasts of continents from the ocean, they bring rain. This can be seen on the long line of coast between Cape St. Roque in South America and the Gulf of Mexico. On the other hand, the western coast of Africa, well north of the equator, is dry and desert, because here the north-east trades blow out from the land. The prevailing winds in North Africa all the year round

are the north-east trades, and as these winds blow over the land and get warmer as they advance, they bring very little rain, and so northern Africa is desert. So, too, the western coast of North America, south of the head of the Gulf of California, gets little rain all the year round, because the prevailing north-east trades blow from the land, and here the map shows patches of desert (Colorado Desert).

2. Just in the same way, **the South-East Trades**, where they blow on to the eastern shores of continents, bring them rain. This can be seen on the eastern coast of Africa, south of the equator, on the island of Madagascar and on the coasts of South America and Australia which face these winds. On the other hand, these south-east trades, when they blow from the west coasts of continents, leave them dry. We can see this by looking at the south-west coast of Africa (where we have the Kalahari Desert), the middle of the Pacific Coast of South America (inland from which is the Atacama Desert) and the west coast of Australia (inland from which stretches the Great Desert of Australia).

3. **Seasonal Winds.**—'Monsoon' is an Arabic word meaning 'season' and it was first used to name our summer and winter winds in India. But there are other winds of the same kind.

(*a*) **Asia.**—In our hot season there is a centre of low pressure over the land mass of Asia, and this draws in winds from the ocean. Thus the south-east trades blowing across the Indian Ocean after they cross the equator are turned into strong, steady south-west winds, blowing across India and Burma. During our hot season they bring much rain to these countries as far inland as the Himalayas and the mountains of Burma, as the map shows.

The low-pressure area over Asia also draws the monsoon winds from the Pacific at the same season. Therefore Siam, Cochin-China, China, Mongolia and the southern Japan islands receive their rain in our hot season from the south-east monsoon. The map clearly shows the monsoon rainfall area in Asia (Fig. 31, p. 100).

(*b*) **Africa.**—In the same way, in our hot season the area of low pressure just north of the equator in Africa draws in the south-east trades blowing across the Atlantic, and this

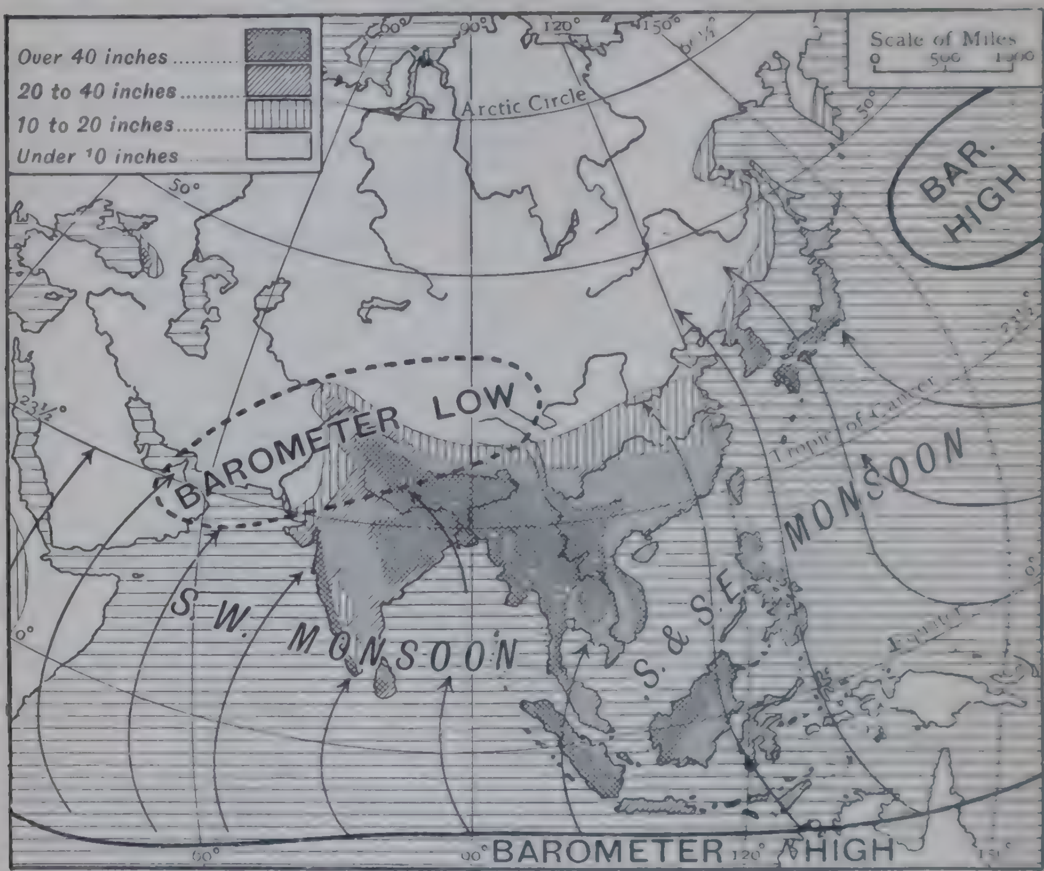


FIG. 31.—The summer monsoon in Asia.

explains the heavy rain belt on, and north of, the equator in Africa at this season.

(*c*) **North America.**—It is the same in the Gulf of Mexico during our hot season. The north-east trades are then blowing on to the West Indies and Central America. But the low-pressure area over the southern part of the United States during this hot season draws these winds round and they blow into the Gulf of Mexico, up the Mississippi valley, and on to the coast of Florida. Hence, during this season North America receives most of its rain.

(*d*) Next, take the hot season in the **southern hemisphere** (our cold season). During our cold months, as we have seen, the monsoon, or north-east trade, then blowing in India, moves

out to the Indian Ocean. It also blows out across the Pacific coast of Asia. Here it is a dry north or north-west wind, but it gives some rain to Japan and the bulging part of China. But when this wind crosses the equator, it is turned to the left and becomes a north-west monsoon wind, blowing rain-clouds on to the northern coasts of Australia. Thus, during our cold season, this part of Australia receives most of its rain from its north-west monsoon. A great deal of rain also falls on the islands north of Australia.

4. **Westerly and south-westerly winds.** (*a*)—In the northern hemisphere these blow fairly steadily all the year round across the north Atlantic and north Pacific, and they bring

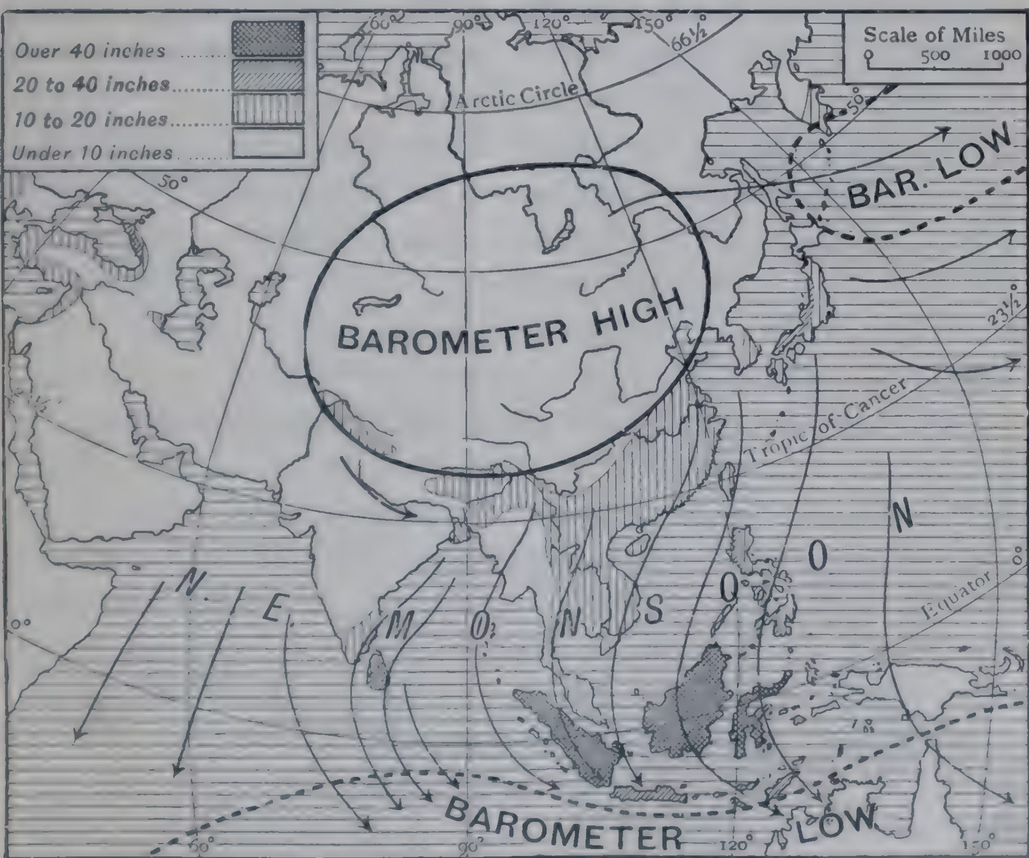


FIG. 32.—The winter monsoon in Asia.

rain and heat to the west coasts of Europe and the Pacific coast of North America. When, in our cold season, the heat belt is south of the equator, these winds reach farther south than they do when the heat belt is north of the equator. Thus,

during our cold season, they reach as far south as the Atlas Mountains in North Africa, and the coasts of the Mediterranean Sea. The Mediterranean coast lands, therefore, receive their chief rains in their cold months. In the summer these winds do not reach them and they get very little rain. Thus they have wet winters and warm dry summers. This kind of climate is called Mediterranean. It suits the growth of many kinds of fruit, such as oranges and figs, which are well ripened in the warm, dry summers. During our warm season, when the heat belt is north of the equator, these westerly and south-westerly winds in Europe blow farther north and give rain over nearly all the middle and northerly parts of the continent. Of course less and less falls as we go inland from the Atlantic. As these winds blow from a warm ocean, they bring plenty of rain and moisture to Europe.

In the same way, in our winter season the westerly winds across the north Pacific blow as far south as California (35° N.), which thus receives its rain in the cold season. In our hot season these winds blow farther north, so that California has a climate like the shores of the Mediterranean, viz. wet winters and warm dry summers. Like them it is a splendid fruit-ripening country.

(*b*) It is much the same in the **southern hemisphere**. In our hot season when the heat belt is north of the equator, the westerly winds blow as far north as 35° S. Thus, at this season, about one-third of the west coast of South America receives rain from the Pacific; the extreme south of South Africa and the southern coasts of Australia, as well as Tasmania, receive most of their rain at this season, *i.e.* in their cold season. In our cold season, when the heat belt has moved south, the westerly winds blow farther south (not farther north than about 40° S.) so that then the southern end of Africa and the south coasts of Australia are out of their reach and are therefore dry. The southern end of Africa and the south coasts of Australia have thus a Mediterranean climate, and are famous for fruit-growing. New Zealand, being in the track of these westerly winds, receives rain from them all the year round and its western coasts are wetter than the eastern.

CHAPTER X.

WORLD CLIMATE.—*Continued.*

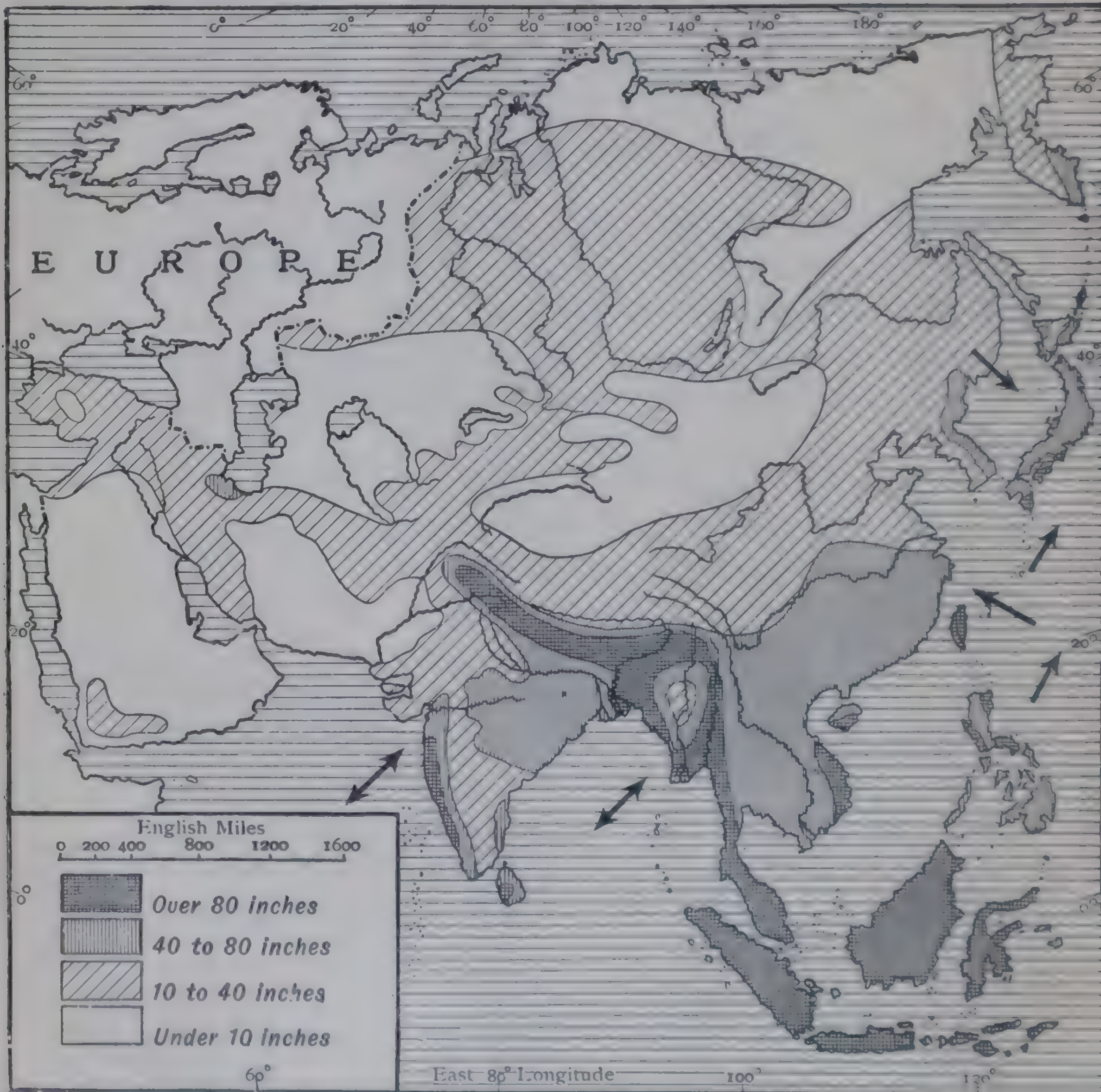
Rainfall of the World: Map Study.—This map shows the rainfall of the world throughout the year. The darker the shading the heavier the rainfall (Fig. 33a).

The map shows most rain falls on the equator and on either side of it. Thus the Malay Archipelago, North Australia, West Central Africa, the north part of South America and Central America are heavily shaded. Why does most rain fall here? Because these parts are very hot and the sun can evaporate a great deal of moisture from the sea and the winds blow it on to the land in the form of rain. Least rain falls in the far north. There the sun cannot evaporate much moisture, for it shines at a great slant. The map also shows that many places lying behind mountains and far from the sea are dry. We also see that on the whole there are fewer and smaller dry patches in the southern hemisphere than in the northern. The reason is, that lands in the former are not so far from the sea and, therefore, rain-bearing winds can reach them more easily.

Asia.—The monsoon region of Asia is clearly marked. The Gangetic valley, the Malabar coast and Burma receive the most rain. Siam, Cochin-China and China receive a little less, because the mountains there are not so high and allow more rain to pass inland (Figs. 31 and 32).

The Japan Islands get rain from the south-east monsoon in our hot season and a little from the north-west monsoon in our cold season. The dark parts of Asia are the only parts which receive monsoon rains. They are, therefore, the most fertile, and they contain more than half the population of the

whole world. The rest of Asia is very much drier. Notice how quickly the rain stops when it reaches the Himalayas: it cannot get past them. Therefore Tibet is a very dry country. Two large deserts are marked in the middle of Asia. The



The arrows show the chief winds which affect rainfall. Emery Walker Ltd. sc.

FIG. 33.—Asia—Rainfall. Notice how much rain the Monsoon Lands receive.

reason for this is simply that they are so far from the sea that the rain-bearing winds cannot reach them. Besides, they are screened from the sea-winds by mountains. Arabia is nearly all a desert. The prevailing wind here is a north-east trade and, as it blows over dry land and deserts, it does not bring

any rain. Arabia has no rivers. Persia, Afghanistan and part of north-west India are also very dry. Our south-west monsoon leaves them on the west and so misses them. Farther north, Asia receives a little more rain. It gets it partly from the wet winds which have passed over Europe. A little also comes from the Arctic Ocean. The most important rivers of Asia are fed by monsoon rains: those flowing into the Arctic are fed by melting snow.

Europe is wetter than northern Asia, because the west and south-west winds from the Atlantic drop most of their rain there, and have not much left to carry into Asia. As these

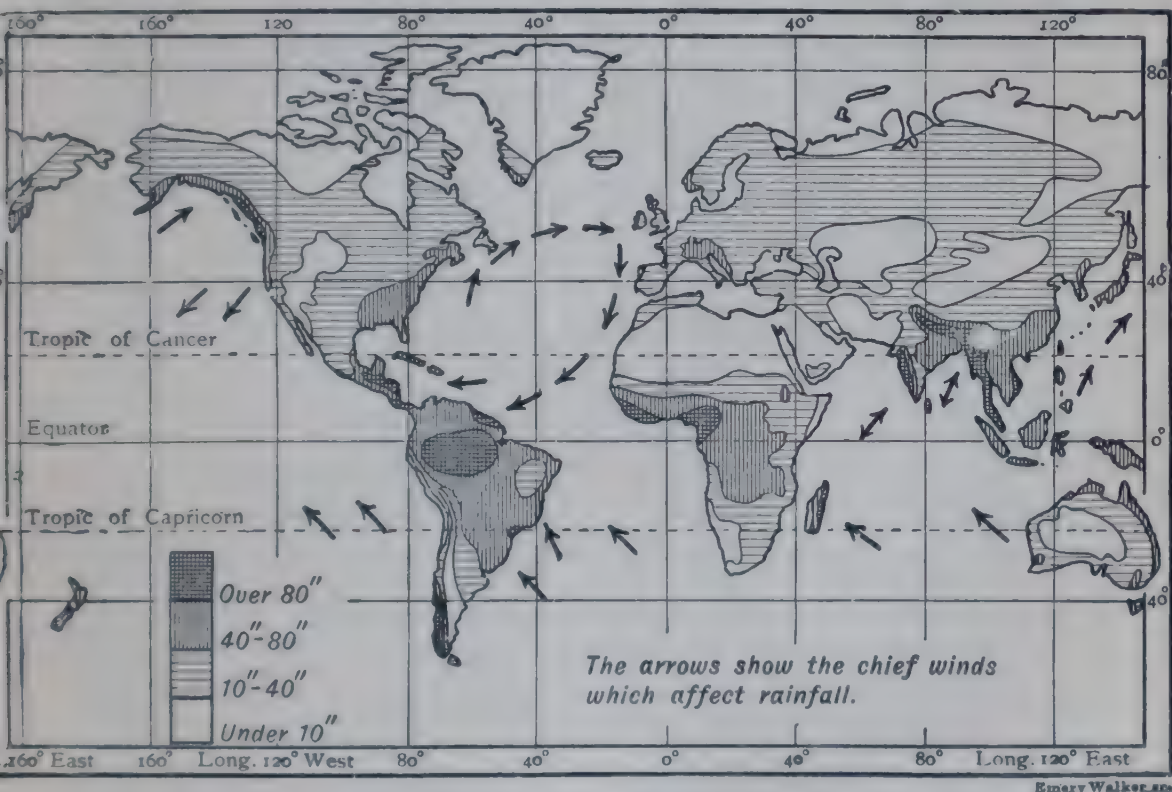


FIG. 33a.—Mean Annual Rainfall of the World.

winds blow from the warm Atlantic, they bring much heat and moisture. The darker parts on the map show the places where mountains catch the rain-bearing winds. The west coasts of Britain and Ireland, being mountainous, catch more than the flat parts. The Mediterranean coasts get a good deal of rain, but, as we have learned, this falls in the winter and the summers are dry.

Africa.*—Most rain falls on both sides of the equator. As we go north or south of this wet belt, less and less rain falls. The rain falling on the wettest part is, we learned, brought by the south-east trades which are drawn in from the Atlantic by the area of low pressure in North Africa, during our hot season. The Congo, as it flows through the heavy rain belt, has many tributaries and is one of the largest rivers in the world. The Niger, rising in the wet belt, flows north-east into the desert and then changes its mind and comes back to the heavy rain belt. Where will it receive its largest feeders? The Nile is more than twice as long as the Ganges. But, for more than half its course, it flows across a desert. If it did not get plenty of water in its early course, it would be dried up before it reached the sea. The Nile is the Indus of Africa.

The northern part of Africa is filled with the largest desert in the world. Here the north-east trades blow and, as they come over dry and desert lands, they can bring no rain. The east coast south of the equator receives rain from the south-east trades. In the south a high range of mountains prevents the rain-clouds from going far inland. The island of Madagascar also receives plenty of rain from these winds; most of it falls on its mountainous side facing these winds.

Australia.*—The rainfall is very easy to understand. The further we go inland, less and less rain falls, and, so, a great part of central Australia is nearly rainless. The north coasts get heavy rain from their summer monsoon, which here blows from the north-west. The Pacific coast faces the south-east trades and gets its rain from them. But this rain is prevented by the long Dividing Range of mountains along this coast from going far inland, and that is one reason why Central Australia is dry like Sind. Another reason is that Central Australia lies in the zone where the trade winds originate. The south coasts of Australia and the island of Tasmania get their rain from the westerly winds in the cool season of the southern hemisphere (our hot season).

South America.*—The north-east coast faces the north-east trades, and the south-east coast as far south as the Plate

* See coloured maps and Figs. 148, 159 and 192.

estuary faces the south-east trades. Thus, nearly the whole of the thick part of the continent receives heavy rain from the Atlantic. But the long line of the Andes ranges prevents these winds carrying rain to the Pacific coast. The Amazon lies in the part which is most darkly shaded. This river, therefore, carries more water to the ocean than any other. Twelve of its feeders are as large as our Ganges. The middle part of the Pacific coast is dry. The Andes prevent rain reaching it from the east, and here the south-east trades blow off the land. The southern end of the continent faces the wet westerly winds blowing from the Pacific. In our hot season these winds blow as far north as 35° S.: in our cold season they only blow as far north as 40° S. But the Andes prevent these winds bringing rain across them. Thus, the south-eastern coast lands are here dry. The map shows the dry part of South America is a narrow strip partly on the Pacific coast and partly on the Atlantic coast.

North America.*—The eastern half of this continent is the wettest. The rain here comes from the Atlantic. As we saw, the north-east trades are, during our hot season, drawn into the Gulf of Mexico and up the Mississippi valley, just as our south-west monsoon is drawn up the Ganges valley. The north-west coast gets rain from the wet westerly winds of the north Pacific. When, in our hot season, the heat belt lies north of the equator, these winds do not blow so far south as they do in the cool season when the heat belt is south of the equator. The middle part of this continent is dry. In the north half of it the wet winds from the Pacific are prevented by the Rocky Mountains from carrying rain far inland; in the southern half of it the north-east trades blow from the land and are therefore dry. Here we see large patches of desert inland from the Gulf of California.

Study the maps of world rainfall carefully. They are pictures of man's home, showing the parts of it where plants and crops grow most easily. These plants and crops give food to him and to the animals which he uses.

* See coloured maps and Fig. 174.

CHAPTER XI.

WORLD CLIMATE.—*Continued.*

Ocean Currents and Ocean Drifts.—We have learned that winds carry heat here and there over the surface of the earth, when they blow from warm places; when they blow from cool places, they bring cold. Our south-west monsoon is a much warmer wind than our north-east monsoon. Now the water of the ocean does the same kind of work, but on a much larger scale. Long ago sailors noticed that their ships were carried over the sea much more quickly in one direction than in another. Every sea-fisherman in India can tell you how the current flows along the coast at different times of the year. It is now known that there are movements of water in all parts of the ocean, and maps have been drawn to show how they flow. These movements are larger than any river; some of them are larger than all the rivers of India put together. These movements are of two kinds. First there are *currents*, or masses of water, flowing like very deep and broad rivers at the rate of several miles an hour. Then there are *drifts* of water on the surface caused by the wind blowing the water along. We can see drifts like this on a small scale even on lakes and tanks, when the wind blows strongly over them. The most important movements of ocean water are caused by the chief prevailing winds of our earth.

There are other reasons why the water of the ocean moves or circulates. Cold water is heavier than warm water, and when water becomes cold it sinks and pushes away the water that was there before; when it is heated, it rises. In deep oceans, the deeper the water the colder it is. At the bottom

of very deep oceans, even in the tropics, the water is very cold. In the oceans round the poles the cold water sinks to the bottom; in the warm oceans near the equator, it rises. Hence, cold water moves slowly along the ocean bottom from the poles towards the equator, where it rises up to take the place of warm water that flows away from the equator along the surface towards the poles. Fresh water is lighter than salt water. This is another reason why water circulates. The rotation of the earth changes the direction of sea-currents just as it changes the direction of the winds. In the northern hemisphere, if a current, or drift, is moving towards the equator, it is turned to its right; if it is moving towards the poles, it is also turned to its right. In the southern hemisphere a current is turned to the left. Of course, when a current or drift meets a coast it can go no further. It may then split up and move along the coast in opposite directions or, without splitting up, it may move along it in one direction.

A map of ocean currents of the world shows that in the three oceans north of the equator the ocean waters circulate as if they were moved in the direction of the hands of a watch. But in our Indian Ocean this motion is only seen when the south-west monsoon is blowing; during the north-east monsoon the circulation is in the opposite direction. In the three oceans south of the equator, there is a circulation of ocean waters, in a direction opposite to that of the hands of a watch. In the Southern Ocean the prevailing winds are from the west. Here, therefore, the ocean drifts also move from west to east (Figs. 34 and 35).

The Currents and Drifts of the North Atlantic.—The north-east trades blowing from the north-west coast of Africa set two currents in motion—one just north of the equator, called the north-equatorial current, and the other just south of it, called the south equatorial current. The north-equatorial current crosses the Atlantic and sweeps along the north-east coast of South America. It is then split up by the West Indies islands. The greater part of it passes to the north of

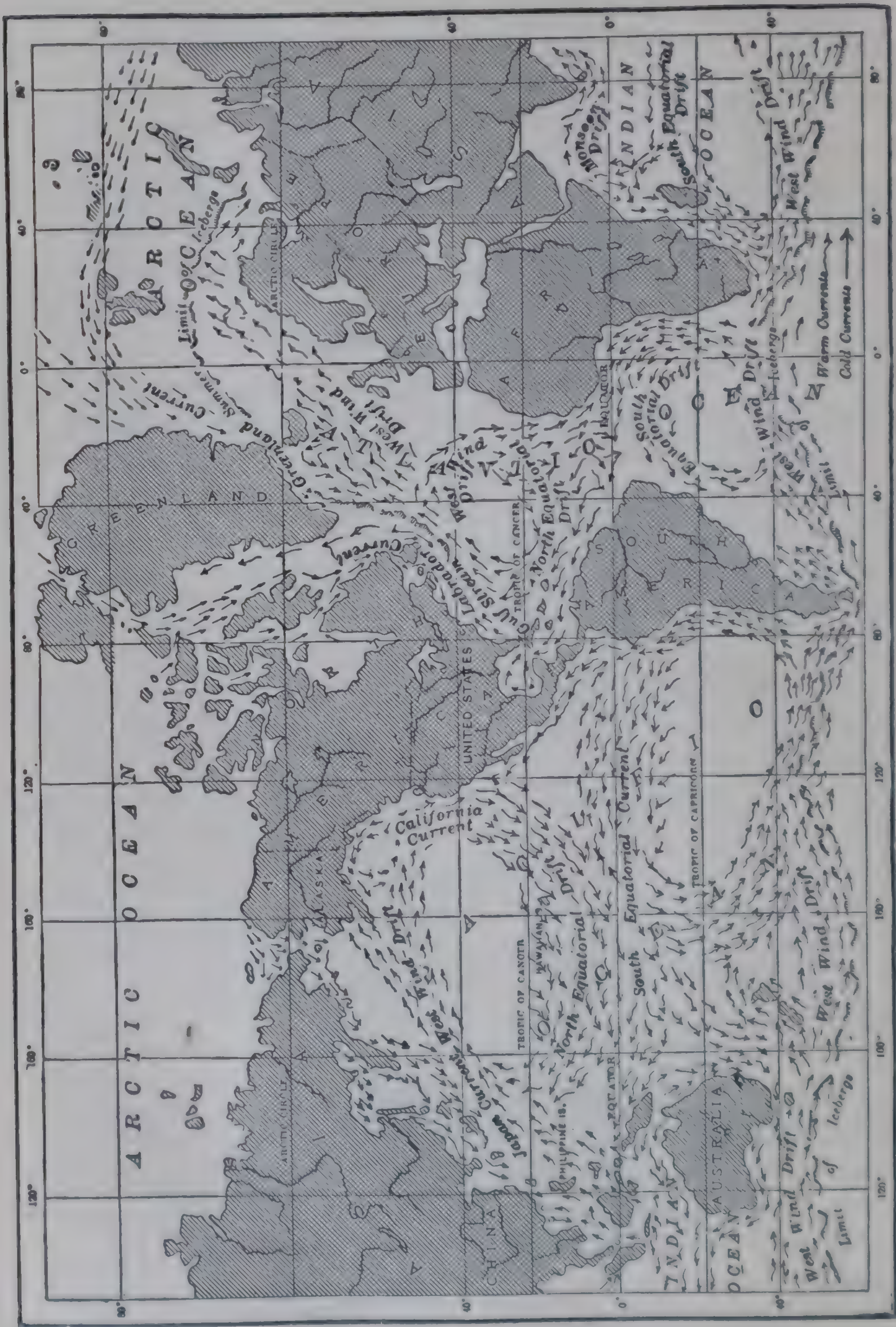


FIG. 34.—The great ocean currents.

these islands, towards the peninsula of Florida. The other part passes among and inside them, enters the Gulf of Mexico, swirls round it and flows out between the Florida peninsula and the island of Cuba, at the rate of about four miles an hour. Here it rejoins the other part and forms the great warm Gulf Stream. This Gulf Stream passes up the east coast of the

FIG. 35.—Warm and cold currents of the Atlantic.

United States and then turns eastwards (to the right), across the Atlantic and spreads out like a fan, becoming shallower and cooler. It is now a broad drift of surface water, called the Atlantic Drift, swept along by the prevailing westerly winds. It sends branches northwards along the coast of Norway into the Arctic Ocean, and round the British Isles. The main body turns south, along the coast of Spain and

Africa, to join the north-equatorial current off the Canary Islands, and begins its long journey again.

The Gulf Stream and the North Atlantic Drift are the most important movements of the ocean. They carry an enormous amount of warm water out of the tropical parts of the Atlantic across its northern part. The Gulf Stream is said to carry with it as much heat as falls from the sun on the whole of India. All this warm water does not itself reach the coasts of western Europe. But the prevailing westerly and south-westerly winds blowing over it carry off from it an enormous amount of heat to the British Isles and the Atlantic coasts of Europe. This heat does not properly belong to them. It is first of all poured into the tropical parts of the Atlantic by the sun, and is then carried to them in sea currents, drifts, wind and rain. Without the Gulf Stream and the Atlantic Drift, Europe would have a much colder climate than it has. We can understand this by studying another current of the Atlantic Ocean. This is the cold Labrador Current which comes from Baffin's Bay, along the coast of Labrador, round the island of Newfoundland, and half-way down the coast of the United States, between the Gulf Stream and the mainland. This current of very cold water carries with it ice-bergs, broken off from the great ice-sheet which covers Greenland. Thus the coasts of Labrador are too cold to grow any crops ; the St. Lawrence is blocked with ice for many months in the cold season ; the land is frozen and covered with snow all winter and no work can then be done in the fields. In the same season on the opposite coasts of Europe, it is quite different. Here none of the rivers flowing into the Atlantic are frozen ; even in Norway snow only falls now and then and ploughing can be carried on.

Currents of the North Pacific.—Here there is a clock-wise circulation of water just like that of the North Atlantic, but on a larger scale. Corresponding to the Gulf Stream and Atlantic Drift the Kuro Siwo, or Black Japan Current (so called because it flows past the Japan Islands), carries much heat to the north-west coast of North America. It strikes

this coast opposite Vancouver Island. Part of it turns northwards, but the larger part turns southward along the coast and then, swerving westwards, joins the north-equatorial current of the Pacific, which flows across that ocean towards the Philippine Islands. The Japan Current brings much heat in warm wind and rain to the north-west coast of North America. There is therefore, in the cold season, a great difference between the mild climate of the Pacific coast of Canada, where no harbours are frozen, and its cold Atlantic coast where for many weeks no ships can make use of its harbours and rivers.

Corresponding to the Labrador Current in the Atlantic, a cold current flows down the Asiatic coast of the Pacific in the same latitude. The winter season is here very cold. Icebergs are carried into the Sea of Okhotsk, the Amur River is frozen for many weeks and so is the harbour of Vladivostok. In the same latitude, on the western coast of Europe, or of America, no iceberg is ever seen, no harbour is frozen. We thus see what a difference it makes to a country whether its shores are washed by a warm or a cold ocean current. The Atlantic Drift is sometimes called the warm blanket of Western Europe.

Currents of the South Atlantic.—The south-equatorial current, after crossing this ocean, strikes the coast of South America and, turning along its south-eastern shores, becomes the warm Brazil Current. Before this current reaches the southern end of the continent it turns eastwards and becomes an eastward drift under the force of the prevailing westerly winds. On reaching the shores of South Africa it turns northwards, as the cold Benguela current, till it rejoins the south-equatorial current and begins its round again.

Currents of the South Pacific.—Here, too, the currents move counter clock-wise. The strong Peru Current flows northwards, up the Pacific coast of South America. Here, even as far north as the Tropic of Capricorn, the water is too cold for a pleasant bathe. The Peru Current turning to the left joins the south-equatorial of the Pacific, which flows across that ocean towards

New Guinea. Along the Pacific coast of Australia there is a south-flowing warm current.

Currents of the Indian Ocean.—Here the circulation is roughly the same as in the Pacific. In the southern part of it the south-equatorial current, after crossing this ocean from Australia to Madagascar, turns south along the African coast as far as the southmost point of the continent, when it swerves to the east under the force of the prevailing westerly winds of the southern ocean, and turns northward again along the west coast of Australia. In the northern half of the Indian Ocean the north-equatorial current crosses from Java to the north end of Madagascar Island and then turns northward along the African coast. During the south-west monsoon this current continues along the Arabian coast, down the western coast of India, and up the eastern coast. It is helped by the south and south-west winds of this season. During our north-east monsoon this coastal current flows in the opposite direction. Thus, during no part of the year are the coasts of India visited by currents or drifts coming from a cold ocean.

Ocean Currents and Climate.—We have learned that winds which blow from the sea to the land often carry moisture, which is condensed on the slopes of mountains and when it mixes with the colder air over the land. But if this wind is blowing over a cold current, it will not take up nearly so much moisture as it will do when blowing over a warm current. The currents flowing along the western coasts of South America, South Africa, and Australia are cold currents. Winds blowing over them on to the land do not bring much rain. This partly explains why most of the Pacific coast of South America, of the southern half of the Atlantic coast of Africa, and the west coast of Australia are very dry. Some parts of them are desert. On the other hand, the eastern coasts of these continents get much rain, because they are washed by warm currents. So, too, the west coast of Canada has a greater rainfall than the eastern, for the same reason. The west coasts of Europe, on to which the prevailing winds blow from the warm Atlantic Drift, get much more rain in the cold season

than the eastern coasts of Asia, in the same latitude, washed by the cold current from Bering Straits.

The life that man lives in any country depends on the heat and moisture it receives. This heat and moisture is brought to it, partly by the winds blowing over his head and partly by the deep waters of the rolling ocean.

CHAPTER XII.

WORLD CLIMATE.—*Continued.*

Climatic Zones.—In geography books the surface of our globe is sometimes divided into zones or belts of climate. If this surface were all water or all flat land, and if the earth only rotated on its axis and did not revolve round the sun in a plane inclined to its plane of rotation, then there would be no seasons. The nights would, of course, always be colder than the days. But in the same place the sun, or moon, would never be higher in the sky at one time of the year than at another. Each place would receive its same amount of heat all the year round. The winds would never change: there would be no monsoons. No place would have a more equable climate than another. Latitude, *i.e.* the angle of the sun's rays, would be the only factor we should have to consider. But we know there are other factors and so we cannot really divide the globe into different zones of climate.

Still, if we think only of the sun's slant, we can divide the globe into five zones.

(i.) **The North Frigid Zone**, lying round the North Pole for a distance of 23½ degrees from it: (ii.) a corresponding zone round the South Pole, called the **South Frigid Zone.** In winter, even at the margins of these zones, the sun does not rise above the horizon for at least twenty-four hours, and at the poles in the centre, he does not rise above it for six months. In summer, even at the margins of these zones, the sun does not set for at least twenty-four hours, and at the poles he does not set for six months. Here, of course, though the sun is never far above the horizon, there is a great difference in the

amount of heat during the long days of summer daylight, and that of the long winter nights of darkness.

(iii.) **The Torrid or Hot Zone** (divided by the equator into the North Torrid and South Torrid Zones) which stretches $23\frac{1}{2}$ degrees north and $23\frac{1}{2}$ degrees south of this line. Within the boundaries of this zone the sun is overhead, at noon, twice in the year. On its margins, *i.e.* on the Tropics of Cancer and Capricorn, for several days before and after June 22nd and December 22nd respectively, the sun is practically overhead at mid-day, and on all places within this zone he is overhead twice in the year. On the equator he is overhead at the equinoxes, *i.e.* on March 22nd and September 22nd. Within this zone the length of the day, throughout the year, is practically the same. Hence the force of the sun is great all the year, and there is but little difference between the heat of winter and summer.

(iv.) and (v.) **The Temperate Zones** lie between the Torrid and Frigid, *i.e.* between $23\frac{1}{2}°$ N. and $66\frac{1}{2}°$ N., and between $23\frac{1}{2}°$ S. and $66\frac{1}{2}°$ S. In these zones the sun, even in winter, never disappears for twenty-four hours beneath the horizon (as he does in the Frigid Zones) and in summer he is never overhead at noon (as he is in the Torrid Zone). As we go polewards across these zones, whether in winter or summer, the sun, of course, shines at a greater and greater slant, but in winter the days are shorter and shorter as we go, and the days in summer longer and longer. Thus, as we go polewards, although the sun shines at a greater and greater slant, yet this is balanced in summer by the fact that he shines for more hours in the day. In winter the opposite is the case. Not only does he give less and less heat, but he shines for fewer hours in the day. For example, in the prairies of Canada, about 50° N., we are in the Temperate Zone, and the sun at noon, even on June 21st, is only $63\frac{1}{2}$ degrees above the horizon, but he shines for over eighteen hours in the twenty-four. Thus the prairies at this season really get as much heat per day as places farther south with a more vertical sun but with fewer hours of sunlight. That is why

the wheat crops on the prairies ripen so well and so quickly. On the other hand, on December 21st the sun is only $16\frac{1}{2}$ degrees above the horizon at mid-day, and only shines for about eight hours in the twenty-four. Thus, in the Temperate Zone, there is a great difference between summer and winter conditions.

But, as we have seen, many other things besides the angle of the sun's rays have to be considered, when we speak of climate. For example, we have to take into account the altitude of a place, and its position in regard to mountain ranges. Patna on the Ganges and Lhasa in Tibet are both in the North Temperate Zone. There are only 4 degrees of latitude between them. But it would be absurd to say they have anything like the same climate. The reason is that one is on a plain and the other on a lofty table-land, and a high barrier of mountains separates them. Indeed, the climate of Patna is more like that of Trichinopoly or Madura, places four times farther away and in the Torrid Zone. Then we must remember that the climate of a place depends on its distance from the sea. Take Montreal, far inland in Canada, and Victoria on the western coast. They are both in the same, or nearly the same latitude, in the North Temperate Zone. But their climates are quite unlike. Montreal has a very cold winter—for five months in the year its average temperature is below 32° F.—and a hot summer. Victoria has a cool winter—in no month of it is the average temperature below 32° F.—and a warm summer, not nearly so hot as that of Montreal. Ocean currents, too, make a great difference. We may say truly that Labrador and the British Isles are both in the same latitude in the North Temperate Zone. But, owing to the cold current flowing from the north the climate of Labrador for most part of the year is very cold, the ground is covered with snow for months, and only very few plants can grow. The British Isles, on account of the warm Atlantic Drift and the warm westerly winds, have a much warmer climate, with but little frost and snow. The Gangetic Plain and the southern half of the Sahara lie in

the same latitude of the North Temperate Zone, but one is well-watered, fertile, with a dense population: the other is a dry, parched, barren desert. If we divide the globe into the five zones marked by parallels of latitude, we can only have a very rough idea of the climate of places in these zones.

Questions about Climate.—We can now understand that if we wish to know the climate of any part of the world we must ask ourselves many questions. Is it near the equator, so that the sun pours heat straight down on it, or nearly straight, for most of the year; or, is it far from the equator, so that the sun always shines at a slant? That is the most important question. Is it cool because it lies high above the sea-level? Is it a small island or part of a continent? Is it near the sea, so that the air is damp and often full of clouds, which give it plenty of rain, and where there is but little change between the warm and the cold season? Or, is it far from the sea, where moisture cannot reach it, and the air is dry, with few clouds and but little rain, and where there is a great difference between the warm and the cold season? Is it, for example, a place like the middle of Persia, where in winter the cold is so great that every drop of water is frozen and in summer the intense heat dries up pools and wells? If it gets very little rain, its rivers will be few and small, and for many months they may dry up. It may even be too dry to have any rivers and be covered with dust, sand and bare rocks, like Arabia or the Thar, or the central part of Australia. What are the prevailing winds; do they blow from the sea and bring rain-clouds, or are they dry winds coming from the land? If the winds blow steadily from the land, even the shores may be desert, as on the western coasts of South America (the middle part), of South Africa, and of Australia. Are its winds warm or cold, and do they change at different seasons, like our monsoons? Does the place lie on the seaward side of mountain ranges which check the rain-bearing winds and so fill its rivers with water, and cover the land with rich crops and dense forests; or does it lie behind mountains which keep off clouds, so that the air is dry and there is little rain to fill its rivers and irrigate its

fields ? Do these mountains keep off warm winds and help to make its climate cold : or do they keep off cold winds and help to make it warm ? What ocean currents flow along its coasts ? Are they warm, so that the winds blowing from over them bring heat and rain ; or are they cold, so that the winds blowing over them are cold and dry ? Perhaps these ocean currents may be cold enough to freeze the mouths of its rivers and block its shores with ice.

When we ask about the climate of a country we are really asking, What kind of a dwelling-place for man does its atmosphere make it ? The climate of a country means how much heat and moisture it receives in the year and at different seasons, but, as we have learned, there are many causes which make a country warm or cold, dry or damp, fertile or barren.

CHAPTER XIII.

HOW TO LEARN GEOGRAPHY.

How to learn Geography.—The best way to learn the geography of any part of the world is to travel over it and to study its high-lands and low-lands, its valleys and rivers, and lakes, and sea-coasts, with our own eyes; to visit its fields and forests, its towns, and mines, and harbours, and factories, and see how the people live, and what they do. We can walk or bicycle over it, or travel in carts, in motor cars, and in trains, or sail up and down its rivers, and along its sea-coasts. Another new way is to sail over it in an aeroplane or an airship, and look down on the places as we pass over them. In these ways man has learned the geography of the world which is his home. Travellers have written books to describe the places and people they have visited. Everyone knows the geography of his own town or village, and the places round about, because his own eyes have taught him. Some of us have learned the geography of our own district in this way, and a few, perhaps, have travelled to distant parts of India. But we have no time to learn the geography of the whole world in this way. So we must learn it by reading books.

Maps—Different kinds of maps.—Another way is to study maps. Maps give us a kind of picture of different parts of the world from which our eyes can learn a great many things very easily and quickly. We might learn arithmetic without using figures and geometry without drawing triangles and circles, but we could learn very little in this way and it would be very difficult. In the same way, when we learn geography,

we must make use of maps and understand the marks on them, for every mark means something. We must also learn to draw them. Everyone knows most of the marks used in maps to show land and water, mountains, rivers and railways. At the side of many maps we find a list of some of the marks used. Some maps, by the use of different colours or shading, show us where the land is high and where it is low and flat. A map of India of this kind shows how high and steep the Himalayas are, and how low and flat the Indo-Gangetic plain is (see Fig. 65). From such a map of the world we can very quickly learn where its chief mountain ranges and plains and table-lands are. Some maps also mark where the sea is deep and where it is shallow. A map of this kind shows that the sea all round the coasts of India is shallow. By it we see that we must sail for 200 miles west from Bombay, before we come to very deep water. A map showing the depth of the sea at different places, how the sea-currents flow and the harbours and light-houses along the coasts, is called a chart. **Charts** have been made of all the chief coasts of the world. They show sailors where they can safely steer their ships and so avoid hidden rocks and sandbanks on which they might be wrecked. A new kind of map is made by taking photographs of the land from aeroplanes high up in the sky.

A globe is a very good kind of map, for it shows the true shape of the earth. We can also with clay or paper and gum make **relief maps,** so that we can feel with our fingers as well as see with our eyes where the high, steep mountains are, and where the smooth flat plains. Other maps show the boundaries between countries, and the size of countries. If they are coloured, they are very easy to understand. These are called **Political Maps**. Maps may be drawn to show many other things. Some show where most and where least rain falls, where the winds usually blow, the hot parts of the world and the cool parts. These are **Climate Maps.** Other maps show where the great forests are and the grass-lands, and where the chief crops such as rice, wheat and cotton are grown. These are **Vegetation Maps.** Then there are **Population Maps,**

showing what races of men inhabit different parts of the world ; maps to show where coal and iron and copper are found, and maps showing where manufactures are carried on. In this way maps show our eyes, very quickly, many things which, without them, we could only learn by reading many books, or by making long journeys and voyages.

Contour Maps.—There is still another kind of map which shows the levels of different places by lines. It is called a

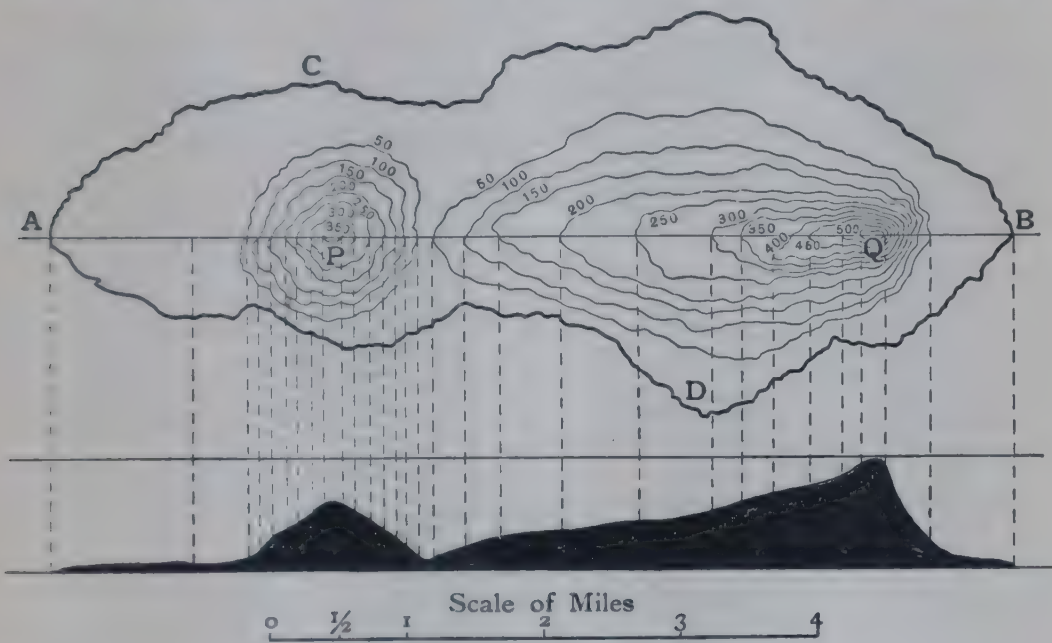


FIG. 36.—Contour map of an island.

contour map, and the lines on it are called contour lines. Look at the contour map. What can we learn from it ?

How to Read a Contour Map.

1. It is the contour map of an island.

2. The lines on it are marked by figures which show heights above sea-level. All the land outside of the line marked 50 is less than 50 feet above sea-level. The land between the lines marked 50 and 100 is more than 50 feet and less than 100 feet above sea-level and so on.

3. Measuring by the scale we see the island is 7 miles long from east to west and 3 miles broad from north to south.

4. It has a low plain all along its coasts, and this plain is broadest at its western end where it is about 1½ miles wide.

5. There are two hills on the island—Hill *P*, which is two miles east from *A*, is 350 feet high and Hill *Q* is 500 feet.

6. Hill *P* is shaped like a cone because the contour lines are marked at regular distances round it.

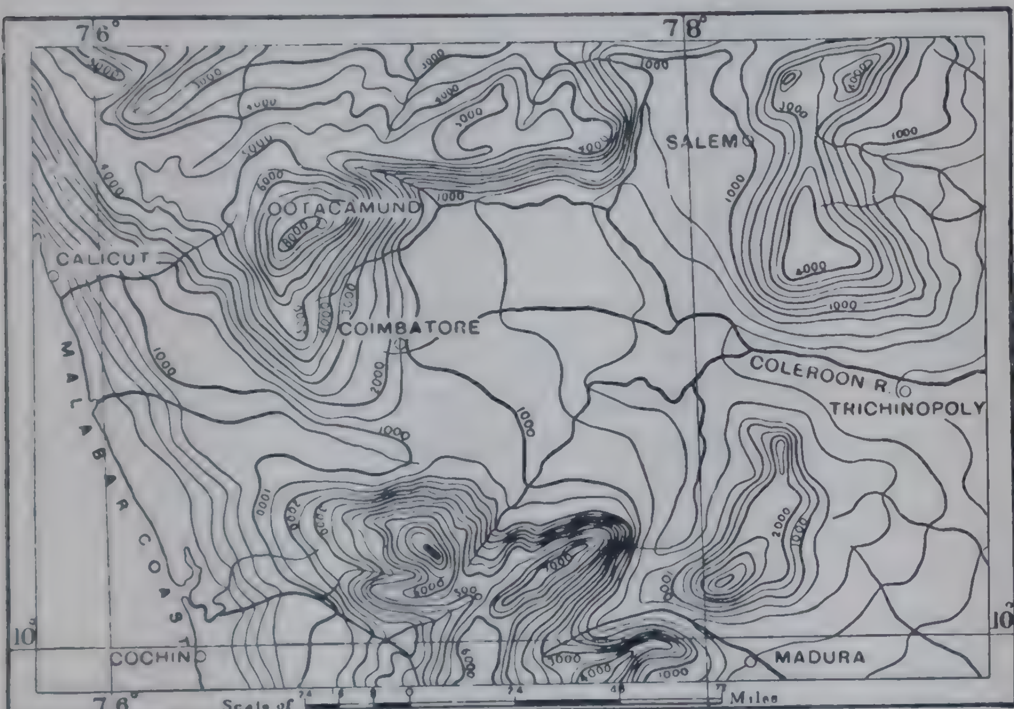
7. The top of Hill *Q* is a mile from the east end of the island. But in shape this hill is quite unlike Hill *P*. The contour lines are far apart on its western side and so its western slope is quite gentle: the contour lines on its eastern slope are very close together and so its slope on that side is steep.

8. If we were to walk straight from *A* to *B* over the tops of the two hills, what should we find? We should first pass over a flat plain for a mile and a half. Then we should begin to climb, and in the next half mile we should climb up 400 feet to the top of Hill *P*. Then, going on, we should descend 400 feet in the next half mile. Here we should be nearly at sea-level again. We should see in front of us a long gradual slope of about $3\frac{1}{2}$ miles to the top of Hill *Q*. After reaching this hill-top we should make a steep descent, for the map shows we should have to climb down 500 feet in less than half a mile. Another half mile over the flat plain would bring us to *B*. Below the diagram is a section showing the ups and downs of the journey. It would be a longer but an easier walk to go round by the flat coast all the way. Engineers must draw and use contour maps, for from them they can learn how to make roads and railways from one place to another by the most level route. It is easier to make roads and railways over level ground than over slopes and ridges or through tunnels. Besides, much less coal is needed to take an engine and its train along level ground than up a slope. On the contour map trace what you think would be the best route for a railway from *C* to *D*.

Fig. 37 is a contour map of part of the Madras Presidency The distance between Coimbatore and Ootacamund is only one-third of the distance between Coimbatore and Salem, but the train journey in the former case takes much longer than in the latter case. The map tells us the reason, for it shows how very steep is the climb up the ghat to Ootacamund. The

line has to twist and turn along the steep slopes of the hills. The train takes about five hours to go thirty-two miles.

Directions.—Any one can draw a map, but to draw a correct map is difficult. To do so we must be careful to show the directions. Ahmedabad is nearly straight north of Bombay. In drawing the map of this part of India we must place the mark showing Ahmedabad nearly straight north of the mark showing Bombay. So, too, the mark for Ahmadnagar must



Note The Contours below 1000 ft have been calculated at 200 ft apart taking the Coast line at 0 and those above at intervals of 500 ft

FIG. 37.—Contour map of part of India.

be placed nearly straight to the east of it. It is usual to draw a map so that the top of the map corresponds to the north, the right hand of it to the east, and the left hand to the west. But maps of the polar regions are often drawn with the pole in the centre. Thus, in a map of the sea round the north pole, all lines pointing toward the centre are pointing northwards.

Scales.—We must also show distances and areas correctly. If we find the distance from Bombay to Surat is just twice the distance from Bombay to Poona, then on our map the distance

between the mark for Bombay and the mark for Surat must be just double the distance on our map between the marks for Bombay and Poona. If the Peninsula of India measures twice as broad straight east from Bombay, as it does straight west from Madras, then our map must show this.

On all good maps there is a scale marked showing how many miles, measured over the real land or sea, go to an inch of the map. Or, the scale may be marked in a different way, *i.e*, by a representative fraction. Thus, if the scale is marked 1 : 50,000,000 or $\frac{1}{50,000,000}$, this means that one inch of the map represents, or corresponds to, 50 million inches (about 790 miles) on the real earth. If the scale is marked 1 : 63,360, this means one inch on the map stands for one mile on the real land or sea.

Just as we can draw a large or a small picture of a house or tree, so we can draw a large map of a country or a small map of it. But we must always draw all parts of it to scale. If the map you draw of the Bombay Presidency or of the Central Provinces is on a scale double the scale of the map I draw, then the distances between any two places on your map must be exactly twice the same distances on my map and the size of your map will be four times the size of mine.

When surveyors draw maps, they first of all, with the help of instruments, find the distances, the area, the directions and the heights of places they wish to show. Then they measure the length and breadth of the sheet of paper on which the map is to be drawn so that they can use a convenient scale. In drawing a map we must have certain lines to measure from. We can tell the exact position of a point on the blackboard if we know its distance from one of the side edges and its distance from the top or bottom edge. In the same way, when we are drawing the map of a small area, such as a playground or village or even a province, we can forget that it is really a curved surface and draw the map as if it were flat, using the sides of our paper as the lines from which we measure. But in fixing the places, and the distances between them, on a map of a

large part of our round world, it is not so easy. Where are we to measure from? We must find lines on the globe to measure from. If our earth turned now this way, now that, we should have no north or south or east or west. But since our globe always spins regularly on the same axis, the ends of this axis, the poles, are always the same. They are two fixed points. All lines joining them are drawn north and south, and we measure distances north or south along these lines. These lines are called meridians. The equator is a fixed line. It is an imaginary circle drawn round the earth half-way between the two poles: and we measure distances north or south from this circle, along a meridian. We can draw circles on the globe, parallel to the equator. In measuring distances east and west we measure from a meridian along the equator, or along one of the circles parallel to it. Every point on the globe is so far north or south of the equator, and so far east or west of a meridian. The meridian we measure from is the prime meridian passing through Greenwich.

Degrees.—We have seen that in measuring distances on a globe we count in degrees. Distances north or south of the equator are measured in degrees of latitude: distances east and west of meridian 0° (the prime meridian) are measured in degrees of longitude. The degrees of latitude are always of the same length, viz. $69\frac{1}{6}$ miles. But, as we go north or south of the equator, the circles drawn parallel to the equator become smaller and smaller. The number of degrees in each of these circles is the same, viz 360. But the length of these degrees, measured in miles, becomes less and less the farther the circles are from the equator. Thus, Baroda, as a map shows, is in 22° N. latitude and 73° 30′ E. longitude, while Mandalay (in Burma) is in 22° N. latitude and 96° E. longitude. This means that Mandalay is $96° - 73\frac{1}{2}° = 22\frac{1}{2}°$ straight east from Baroda. If both these towns were on the equator, the distance between them would be $22\frac{1}{2} \times 69\frac{1}{6}$ miles, because at the equator a degree of longitude is $69\frac{1}{6}$ miles in length. But, since these towns are so many degrees north of the equator, when we measure the distance in miles between them, we are measuring

east and west along a circle which is smaller than the equator. Therefore, though the distance between them is $22\frac{1}{2}$ degrees, yet each of these degrees is less than $69\frac{1}{6}$ miles in length. It is only about 64 miles.

Latitude.—We have learned that the axis of the earth always points in the same direction. The north end of this axis, *i.e.* the north pole, is straight under the pole star. At the north pole this star shines straight down on the earth.

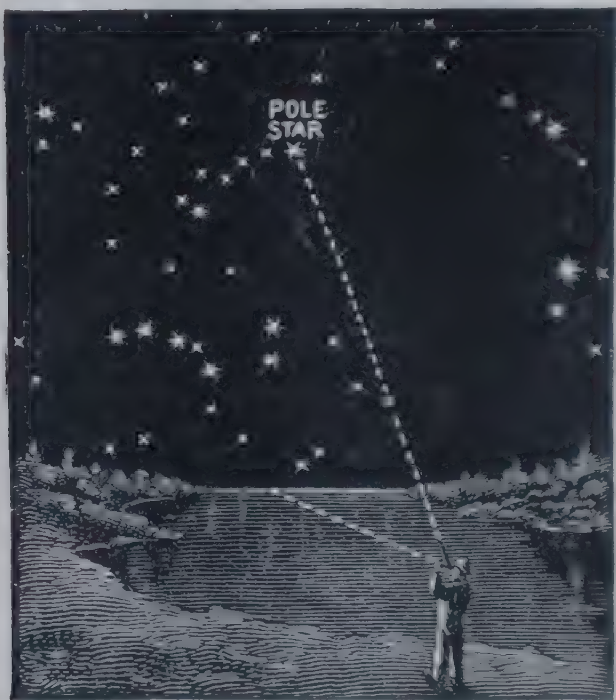


FIG. 38.—Finding latitude from the North Pole Star.

The light from it strikes the surface of the sea at the north pole at an angle of 90 degrees. But, as we go southwards from the north pole, this star is no longer straight overhead. It shines more and more slantingly. When we are in the middle of Asia, it is only half-way up the sky. In India it is still lower. At Baroda it is only about a quarter up the sky, at Bombay and Poona it is still lower, at Cape Comorin it is very low. At last at the equator it shines at the greatest slant: it is on the horizon. It there shines at an angle of 0°. The farther a place is from the north pole, the less is the angle at which the pole star shines on it, and the nearer to the horizon

does it appear. What does this mean? It means we can tell the distance a place is from the equator by measuring how high in the sky the pole star shines. At any place in the northern hemisphere by measuring the angular distance of the pole star above the horizon, we can tell the latitude of that place. If, in pointing to this star, we have to lift our hand through an angle of 50 degrees from the horizontal position, then the latitude of the place where we are standing is 50 degrees north. The measurement of this angle of elevation of the pole star can be made very accurately with instruments. In the southern hemisphere where the north pole star is not visible, the latitude of any place can be found by using the stars visible there, but it is a little more difficult because there is no star just above the south pole. Latitude thus simply means distance north or south of the equator, measured in degrees on a line straight north and south, *i.e.* along a meridian. The latitude of Bombay is 18° 55′ N. This means that at Bombay the angular distance of the north pole star above the horizon is 18 degrees and 55 minutes.

To find latitude from the sun.—The latitude of a place can also be found by observing the position of the sun. We can either measure his angular distance from the horizon as we did with the north pole star, or, we can measure his angular distance from the zenith. In reckoning latitude from the sun's position we always speak of his angular distance from the zenith, or his zenith distance.

Now on March 22nd and September 22nd the sun, at noon, is overhead (in the zenith) at all places on the equator. On these dates his zenith distance at the equator is 0°. On these days he is shining at a slant on all places north and south of the equator, and this slant is greater the farther a place is from the equator. His zenith distance increases as we go north or south of the equator. On these dates, at the north and south poles he is shining at a very great slant, namely 0°, and he is therefore just on the horizon, *i.e.* his zenith distance is 90 degrees. Thus, on March 22nd and September 22nd, the latitude of a place is the zenith distance of the sun at noon,

measured in degrees. Now, if the sun at noon always shone straight over the equator, his zenith distance at any place would be the same all the year round. But, as we have learned, the sun does not do this. His position in the sky is always slowly changing. Between March 22nd and September 22nd he is, at noon, shining overhead on places, one after another, which lie in the northern tropics. During the other half of the year he is shining overhead on places in the southern tropics. His zenith distance changes from day to day. Does this mean the latitude of a place changes from day to day? Surely not. In reckoning latitude from the sun, we must allow for his position north or south of the equator (this is called the sun's declination) on any date except March 22nd and September 22nd, when he is over the equator. For example, on June 22nd the sun is over the Tropic of Cancer, *i.e.* $23\frac{1}{2}$ degrees north of the equator. If on that day at a place in the northern hemisphere the sun's zenith distance at noon is, say, 50 degrees, the latitude of that place is $50° + 23\frac{1}{2}° = 73\frac{1}{2}°$ N. If at a place in the southern hemisphere, his zenith distance at noon on that day is 50 degrees, the latitude of that place is $50° - 23\frac{1}{2}° = 26\frac{1}{2}°$ S. Similar calculations must be made when the sun is over the Tropic of Capricorn on December 22nd.

Take the case of Bombay. Here on March 22nd and September 22nd the sun's zenith distance at noon is 18 degrees 55 minutes. That is the latitude of Bombay, viz. 18 degrees 55 minutes north. On December 22nd his zenith distance at noon is 42 degrees 25 minutes (he is nearly half-way down the sky) but he is then $23\frac{1}{2}$ degrees south of the equator: we must therefore subtract $23\frac{1}{2}$ degrees from 42 degrees 25 minutes, which gives us 18 degrees 55 minutes north, as the latitude of Bombay. Once more, at noon on June 22nd, the sun's zenith distance is 4 degrees 35 minutes (north of the zenith) and we subtract this from 23 degrees 30 minutes, which again gives us the latitude of Bombay. On May 16th and again on July 29th the sun's zenith distance is 18 degrees 55 minutes: he is therefore overhead at Bombay on these dates. The sun's

declination north or south for every day in the year is given in the Nautical Almanac. Thus sailors at sea can find their latitude at noon on any day, by observing the sun's zenith distance and allowing for declination. Every captain of a ship is very careful to find his latitude every day, from the sun at noon. It tells him exactly how far he is from the equator. If the sun is covered by clouds, he can find it from the north pole star at night, or, if he is sailing in the southern hemisphere, from a star nearly over the south pole. By the help of instruments and the nautical almanac he can tell his position from any star. He plots the position of his ship at noon every day of the voyage on a chart which he keeps.

Longitude.—We have seen that, as the earth rotates through 360 degrees in twenty-four hours, it must rotate through 15 degrees in one hour. A telegram can be sent from Bombay to Aden in one second. If this telegram is sent out exactly at sunrise in Bombay, the observer at Aden finds he has to wait 1 hour 47 minutes 36 seconds after receiving the telegram, before he sees the sun rise. This means that Bombay is farther east than Aden by 26 degrees 54 minutes. If we know the difference in time between the sunrise (or noon or sunset) at one place and at another, we can easily calculate the distance in degrees, east or west, between the two places. And if we know the distance in degrees, we can easily calculate the difference in time.

Every captain of a ship carries on board a chronometer (a very accurate time-keeper) which keeps Greenwich time throughout his voyage. If he finds, when he comes to a place, that it is there noon while his chronometer shows Greenwich time to be 3.40 p.m., he knows the place must be 55 degrees west of Greenwich. Greenwich has rolled into the noon position $3\frac{2}{3}$ hours before the place in question has reached that position—$15° \times 3\frac{2}{3} = 55°$. If the captain comes to Mangalore, he finds that, when his chronometer shows noon, the time at Mangalore is 5 p.m. Mangalore has noon 5 hours before Greenwich. It is, therefore, 75 degrees east of Greenwich. Its longitude is 75 degrees east. If the mail steamer

from London enters Bombay harbour when her chronometer shows 1 hr. 8 min. 24 sec. a.m. and the longitude of Bombay is 72 degrees 54 minutes east, what time is it at Bombay ?

When we know both the latitude and longitude of any place, we know its exact position on the globe. Thus, in making a globe (or map) of the world, we first draw on it the equator and the meridian of Greenwich. These are the lines from which we measure. Then we look up the longitude and latitude of every place we wish to mark and plot it in, measuring north or south of the equator and east or west of the Greenwich meridian. The latitude and longitude of all known places have been found. They are kept in observatories and a list of them is printed at the end of good atlases. In making a globe or map, we should certainly make mistakes if we first marked in the places and afterwards drew the equator and the meridians. In old maps, drawn before travellers and sailors knew how to find the latitude and longitude of places correctly, we find many mistakes.

Projections.—If we wish to give a good representation of the earth, we must make a model of it. We must make a globe of the same shape as the earth. We cannot conveniently make a large globe. A globe of ordinary size, such as a school globe, shows us clearly the shape of the earth, the size, position and general features of the continents, islands, oceans and seas, but it is too small to show any details. But if we try to draw a map of the earth on a sheet of paper, we cannot do it accurately. The earth is round and the sheet of paper is flat. If we draw a map of a small part of the earth, such as a village or tahsil, the map can be made fairly accurate, for we are only showing a small area, where the curvature of the earth is not noticeable. But if we draw the map of India, or of a continent or of the world, then we are making a map of a large part of the globe and how are we to show that its surface is curved ? How are we to show that the most easterly part of Eurasia is really on the *other* side of the world from the most westerly part ? We cannot do it.

Suppose we make a globe and paint or draw on it the continents and seas in their proper places, and then take a photograph of this globe on paper. The photograph would not be a true map of the world. Firstly, we can only photograph one half of the globe at a time—our map is therefore not complete. Secondly, the part in the middle of the photograph would look larger in proportion than the parts at the margin of it. We should see the middle parts face to face, but those at the margin would be seen sideways. They would be foreshortened.

Mercator's Projection.—Suppose we try to make a curved map flat. Draw the continents and seas carefully on the outside of a hollow india-rubber ball. Next, cut this ball right through the middle from pole to pole, along the meridian 0° and 180°. We have now two hollow hemispheres which we can place on a table side by side, their convex surfaces uppermost, with the equator running straight across them. Lastly, stretch the two hemispheres until they lie quite flat, and nail them down to the table, so that they appear as in the map below. We know this cannot be a true map because we have stretched some parts more than others.

We can do the same thing in another way. Suppose we draw the continents and seas carefully on the outside of a sphere. Place this sphere inside a cylinder of the same diameter as the sphere, so that the equator touches the cylinder all round. From the centre of the sphere draw straight lines to various points on the map on its surface, and produce these lines to meet the cylinder. In this way, the coast lines, mountain ranges, and courses of rivers on the map will be projected on to the surface of the enveloping cylinder. Now cut the cylinder along a line parallel to its axis, unfold it and lay it flat on the table. The map thus drawn is called a plain cylindrical projection, centrally projected. The common Mercator's map* is a modification of it. Let us see why this is not an accurate map.

1. On the globe parallels of latitude become shorter and shorter, as we go from the equator towards the poles. But on

* The coloured map of Trade Routes in this book is a map of this kind.

this map they are all equal. 2. Meridians on a globe get nearer to each other as we go north or south from the equator, till they all meet at the poles. But on this map they are all parallel. From this we see that on this map all countries and islands and continents north or south of the equator are shown much broader east and west than they should be in proportion, and, the farther we go north or south, the more out of proportion they appear. In fact, the map has been stretched in an east and west direction, and this stretching is greater the farther we go from the equator. 3. To make up for this stretching east and west, the map is also stretched in a north and south direction. The distance between 0° and 15° N. is less than that between 15° N. and 30° and that, again, is less than the distance between 45° N. and 60° N. and so on, both in the northern and southern hemispheres. The map is stretched out east and west but it is equally stretched out north and south. Thus, if, at 60 degrees from the equator, an island measures twice as much east and west as it should measure, it also measures twice as much as it should north and south. It therefore appears four times as large as it should appear. Its shape is right but its size is wrong. Thus, in Mercator's map, Greenland looks much larger than India, but it is really much smaller. The chief advantage of such a map is that it shows directions correctly. It gives the correct direction north and south, east and west, between two places. It is therefore a useful map for sailors * and such maps are used on ships. But otherwise it is of little use. Beyond latitude 80 degrees it is very much out of scale.

Here is another projection map of the world (Fig. 39). Unlike Mercator's projection, it shows the size of continents and islands correctly, but the distances and directions are all wrong. Look at the meridians and find out why this is so. This map is of little use to sailors. No flat map can give a perfectly true picture of our round globe.

Maps are pictures of different parts of the world, and these pictures are bound in books called atlases. In studying geography we do not need to remember the names of all the

* *Mercator* means merchant or sailor.

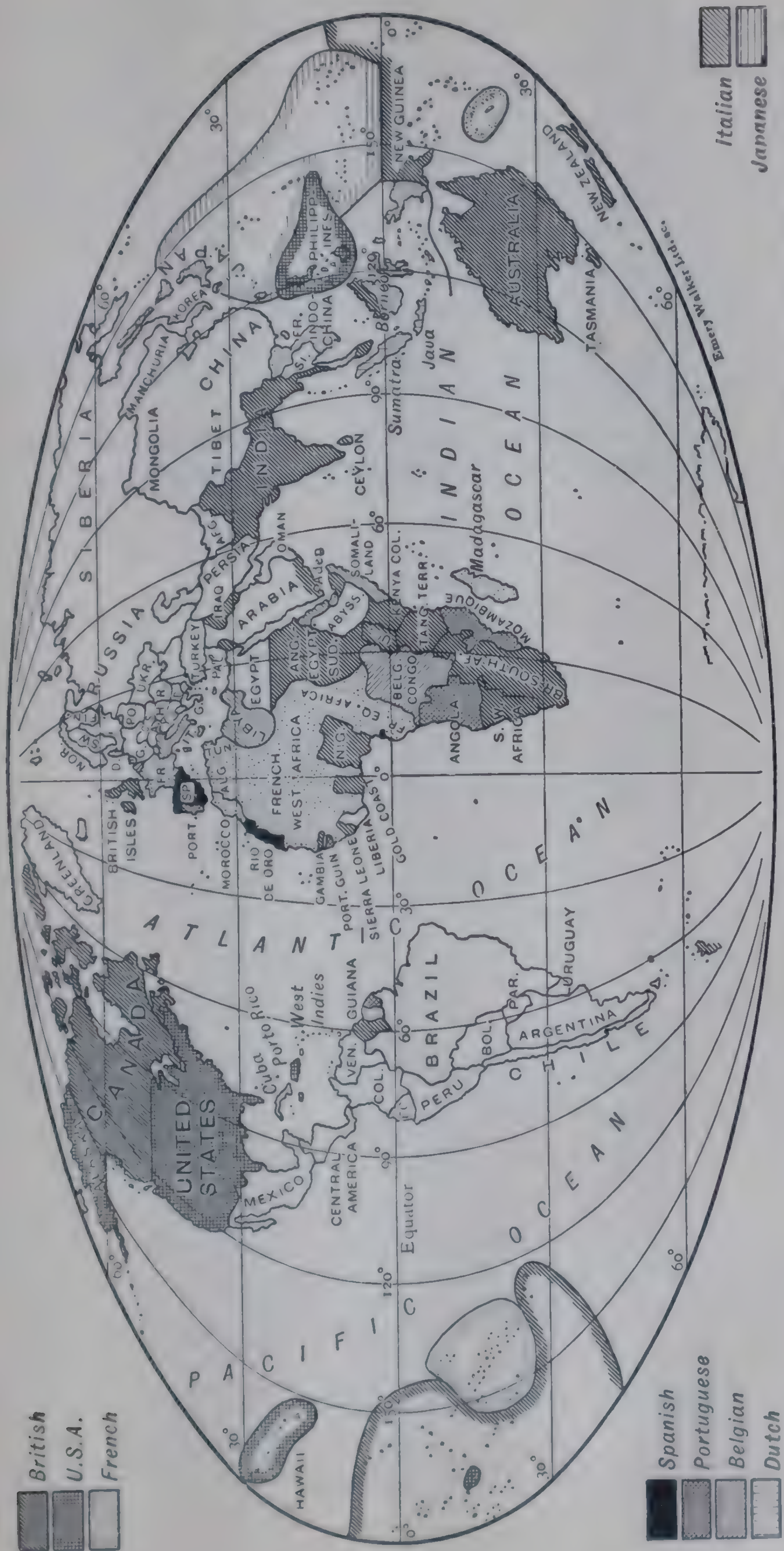


FIG. 39.—This flat map tries to show the whole round world; therefore it must be inaccurate. (It also shows the chief political divisions.)

towns and places. No one could do that. We should know, of course, most of the places in India and all those in our own province or state. But we need only know the chief rivers, mountains and towns in foreign countries. The names of other places we can see on the map. In this book there are maps of most of the countries of the world, but we need not try to remember all the towns marked on them.*

In learning geography we find out answers to questions beginning with Where? What? and Why? But the Why questions are the most important.

* The coloured maps give all the place-names, outside of India, Burma, and the British Isles, which an Indian student need know.

CHAPTER XIV.

THE SURFACE OF THE EARTH.—LAND AND WATER.

THE surface of our globe is not everywhere the same. The map shows that nearly three-fourths of it is covered by salt water. Over some parts this water lies very deep—in certain places nearly five miles deep. In other places it is shallow. Thus the floor of the ocean is not level and flat. To the different parts of this vast area of salt water we give different names, such as oceans and seas, gulfs, bays and straits.

It is the same with the dry land. Our eyes tell us that the land round our home is not everywhere of the same level, and on the map of the world we see some parts of our globe are high and rough and other parts are low and level. We give these parts different names such as mountains and hills, table-lands, plains and valleys. The shape of the land is irregular in another way. It is not all of one piece. It is divided up by oceans, seas, and straits into different parts. To these parts we also give different names, such as continents, peninsulas, isthmuses, capes and islands. Each part has an outline, or coast, of its own. A map of the world shows how different these outlines are. Some, like that of Africa or the coast of India, are easy to draw, for they are regular ; others, like that of Europe, are difficult to draw, for they are uneven and broken.

In learning geography we study from the map what parts of our earth are high and what parts are low, and how the land slopes and how the rivers flow. When we study the chief mountain ranges and valleys and plains, we learn the **relief** or **build** of our earth and of different countries. Every one knows the names and positions of the five great oceans, of many of

the seas that belong to them, and of some of the straits that join these oceans and seas. We have also learned the names of the great masses of land called continents, and on a map we can trace the outline of their coasts, their peninsulas, capes and islands.

But when we have done this, we may ask a question. How did the surface of our globe come to have the build and outline we see on the map ? What shaped the mountains and valleys, the sea-coasts and islands ? This is a very difficult question, and no one can answer it fully. But we can be sure of one thing. These mountains and plains and coasts of the land and the deeps of the ocean were not made by chance. They were shaped by certain forces. Men have studied these forces and learned how they work, so that we can partly understand why the surface of our earth is not even, but rough and broken. One reason why it is so difficult to grasp in our minds how the dry land and the oceans have been shaped is because our earth is millions and millions of years old. A lakh of years is only like a day in the history of our earth. During that long, long time its build and shape have been changed over and over again. Continents have appeared and disappeared. Where we now see the lofty Himalayas, there was once a wide ocean ; where we now walk over flat plains and valleys, there were once high table-lands. At one time the country we now call Assam was under the sea. The Aravalli Hills are but the stumps of a great mountain range of long ago. At one time dry land joined India with Africa and Ceylon. During long ages the whole surface of our globe has been changed and again changed. How did these great changes take place ? Are they still going on ?

The Earth's Crust : Primary Rocks.- To understand the reason we must remember that the surface of the earth on which we live is only a thin crust or covering. It is made up of rocks and minerals, and is not smooth but irregular. But it is the only part of our earth about which we know anything. What makes up the mass of our globe beneath this crust, we do not know for certain. But of one thing we are sure—it is

very hot. If we go down a deep mine, such as those on the gold-fields of Kolar, which only pierces the crust for half-a-mile, the heat gets greater the deeper we descend. It is found that as a rule the temperature rises 1° F. for every 50 ft. we go below the surface. Even a few miles down the heat must be greater than that of any fire we can make. At a depth of thirty miles it must be great enough to melt rocks. We know this because in many parts of the world melted rock, called lava, ashes and steam are vomited up through deep cracks and holes in the crust. In other places warm or hot water rushes up to the surface in hot springs. Some of these springs often send a column of steam and boiling water spouting into the air.

FIG. 40.—Section of the earth showing density.

Fig. 40 shows an imaginary slice or section of the earth. Its outer edge or crust is made up of cooled solid rock. Beneath it is an intensely heated mass. Above the cool crust lies soil and the water of oceans, seas and lakes. Above that again floats the atmosphere which becomes thinner and thinner as we go up.

It is believed that long ago the whole earth was much hotter than it is now. Perhaps at one time it was a ball of blazing gas like our sun. During long ages these gases cooled into liquid. Our earth was then a globe of molten matter, held together by gravity. Of course, there was then no water on it, nor life of any kind. Then this liquid in turn began to cool. Slowly, slowly through ages and ages the outer surface of the liquid globe, as it cooled, turned into what we call rock, which covered it with a crust, as an orange is covered with its rind. At first this rock was not hard but soft and only partly cooled. The surface, therefore, was not smooth. It was constantly

heaved and tossed while it was still soft. In this way the surface was shaped into heights and hollows. When this surface was cool enough to hold water, these hollows were filled with oceans and seas. The heights became mountains of solid rock. In many parts of India we find mountains which are made of this old, hard, solid rock. If we climb the Nilgiri Hills or the Anaimalais, we are standing on one of the very oldest parts of the earth, which has remained as it was from the beginning. Looking out of the train as we pass through the Palghat Gap, we see great slopes, cliffs and hills of solid rock, which were shaped in this way. Gradually the whole globe was completely covered with a crust of rock, which cooled down till it was hard and solid for miles deep. This kind of fire-made rock forms the core of all the great mountain chains of the world and the foundations of all the great table-lands. It is called Old Rock or Primary * Rock, because it was the first that was formed. It is also called Igneous—a Latin word which means 'made by fire.' We might also call it Mother Rock because, as we shall see, all the other rocks were made out of it. If we examine a piece of this Primary Rock, we can see by marks and streaks on it that it was once molten and soft, and was squeezed and twisted as you can squeeze a piece of soft clay (Fig. 41).

The mass of the globe under its crust is still intensely hot. We cannot say it is made up of rocks, because rocks are formed by cooling. But, probably, it is made of rock-stuff, *i.e.* of minerals intensely hot and yet as solid as steel. Owing to the great pressure from above there can be no empty spaces. The mass is too solid to be bent or broken. If at any place this intensely hot stuff escapes through the crust, its pressure gets less, and it becomes molten and pours over the earth's surface, where it cools and becomes what we call igneous rock.

Earth-movements.—But the central mass of the earth was still too hot to remain quiet. As the earth cooled, it contracted. It shrank a little in size, and became wrinkled, just as a mango does when it dries. This also helped to make

* This kind of rock is often called Archaean (or Ancient).

heights and hollows on the surface. Parts of the solid crust might sink as they became too heavy to be supported from below. The floor of the ocean might sink, and there the water would become deeper. To balance this, some other part of

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(about $^1/_{15}$ natural size)

FIG. 41.—Picture of hard rock showing how it was squeezed when soft.

the surface might be raised. When the Andes were raised, it is thought that the floor of the Pacific lying west of them sank down. The same thing happened on the land. Some parts might rise higher than the level of the sea: others might sink nearer to that level or even below it. When the Himalayas were raised, a deep trough was hollowed south of them, which

has now been filled up and forms the Indo-Gangetic Plain. Ceylon was once joined to India.

The intensely hot matter beneath often burst through the crust, where it was thin or weak, and poured over the surface. Sometimes it only bulged it up without bursting through. One awful change of this kind took place on that part of the earth which we now call the Deccan of India. Out of deep cracks streams of molten rock poured, as water flows out of flooded wells. This melted stuff spread all over the surface, filling up all its hollows and blotting out the former shape of the land. Gradually it cooled and formed hard rock. Then more and more molten rock poured out of more cracks and

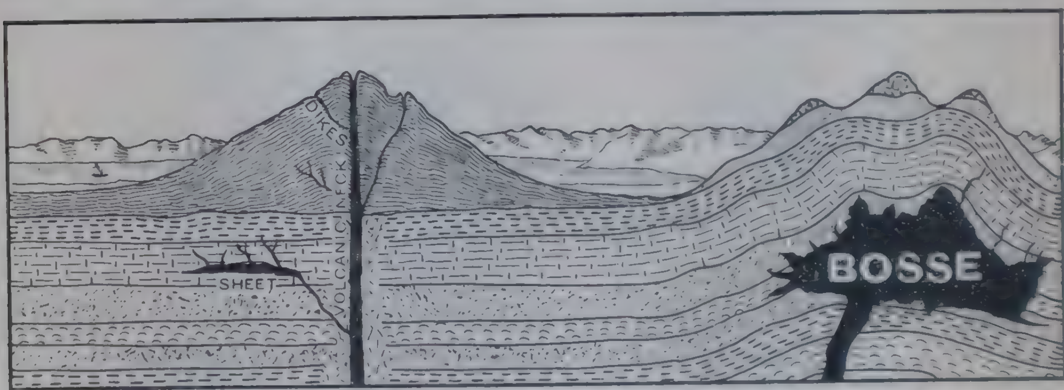

FIG. 42.—Melted rock bursting into and through layers of solid rock.

spread everywhere till, at last, after thousands of years, a great table-land, which we now call the Deccan table-land, thousands of square miles in area, was built up on top of the original crust. In some places the rock of which it is made is still half a mile thick. At one time it covered the surface of the peninsula of India from near the Sulaiman Mountains to the mouth of the Godavari.

And what happened in India during these long ages, millions and millions of years ago, happened also in other parts of the world. These mighty forces were at work for ages, longer than we can imagine, shaping and changing the surface of our earth, not once or twice, but over and over again. We call them earth-movements. For ages they have never ceased. They are still at work. But, now that the earth has cooled deeper and deeper, they are not so frequent nor so violent.

Thus, the islands of Japan are being slowly raised up, but so gently that no one living on them notices it. Some coasts have sunk and are still sinking; others have risen and are rising. Earthquakes still take place, making great cracks in the ground, shaking down houses and towns, lowering the seashore, so that the sea flows in and drowns hundreds of people. Volcanoes in many parts of the world sometimes pour out ashes and melted rock. But even earthquakes last for only a few moments now, and volcanoes burst out only here and there, now and then. Most of them are now dead. But long ages ago, when the dry land and beds of ocean were being shaped and re-shaped, movements took place greater than a thousand earthquakes, and stronger than a thousand volcanoes, and they went on for thousands of years.

We have now learned how the crust of the earth was made and shaped. This is the part of our globe which we know and on which we live. It consists of Primary Rocks made by fire. It is the framework of Man's Dwelling Place. The forces that shaped this framework and formed these rocks came from the great heated mass of the globe itself; they acted from beneath. Wherever we dig down, if we dig deep enough, we come to this kind of rock. It is a kind of floor deep down. It lies even beneath the muddy bottom of all the oceans. Engineers have dug and bored down into the soft mud of the Indo-Gangetic Plain for hundreds of feet without reaching this rock, but we know it must be there, very deep down, like a hard solid floor. In other places, as in the Nilgiri Hills, this rock is on the surface and we see it shaped into bare slopes, steep cliffs and rocky peaks. Maps have been drawn to show the kinds of rock lying beneath the surface in every part of India.

CHAPTER XV.

OTHER FORCES WHICH SHAPED THE SURFACE OF THE EARTH.—WEATHERING.

But most parts of the earth's surface are covered with quite different rocks, which were formed out of the Primary rocks in an altogether different way. And the forces which formed these younger rocks are quite different from those which formed the old Primary rocks. They do not act from within the surface, but from outside it. We can see them at work every day round us. These forces are heat and cold, dampness and dryness, water, air, etc. They do not seem to be so violent as the earth-movements which have raised mountains and sunk the floors of seas. But they are at work night and day in all parts of the world. Everything on the earth's surface on which the hot sun shines, on which the rain falls or over which the wind blows, is gradually changed. This change is called **Weathering.** It takes place in many ways. Wood rots, iron rusts, stones are broken when they fall, and rocks are worn away by water. Chemistry teaches us how acids in the air and in water dissolve substances such as iron, marble, chalk or lime.

Water does most of this work of weathering. Animal and vegetable substances rot when placed in water. Steel is one of the hardest substances; yet steel rusts. Every rock, however hard, is made up of small particles. Water has the power of finding its way among these particles. Some rocks such as sandstone and lime are porous, and allow water to pass easily among their particles. In most rocks, too, there are tiny cracks through which water percolates. Again, rocks contain

minerals and all water in rivers, rain and pools contains gases and acids. The water, by the help of these gases and acids, dissolves the minerals in the rocks and carries them off, so that the rocks begin to crumble. Mortar made out of lime and salt sea-sand soon crumbles, because the rain dissolves the salt particles in it. Again, just as water rusts a piece of iron so that at last it turns into soft dust, so it changes the minerals in rocks. We often see red or yellow stains on rocks or in soil. This is caused by the rusting of the particles of iron they contain.

Thus every rock exposed to the weather, *i.e.* to rain, heat and wind, gradually crumbles—slowly, if it is hard, more quickly if it is soft. A large sacred pillar of hard granite was, some years ago, taken from the dry climate of Egypt, where little rain falls, and set up in New York, where plenty of rain falls, and where the winter is very cold and the summer hot. In five years it changed more than during 3400 years in Egypt. The letters cut on it began to disappear, its surface began to crumble, and soon a heap of dust gathered at its base. It is the same everywhere. Look at the foot of any old wall or cliff and you will see some of the rubbish worn off it has fallen to the ground.

Ice.—When water changes into ice, it expands with great force. In cold countries and on high mountains, water, finding its way into cracks, sometimes freezes. It expands, and the ice splits up the rocks like a wedge. Again, coolies roast stones and then plunge them into cold water in order to break them easily. In the same way, when a rock is heated by the sun during the day, it expands a little, and in the coolness of the night it contracts. In India, rocks are dried up in the hot season and soaked with rain in the monsoon rains. No rock, however hard, can stand this long; it is bound to crumble sooner or later. All over the Deccan we see huge rocks split into pieces lying one on top of the other or scattered about. We might think that giants had been breaking them up, but this is the work of weathering. All air contains some water, and damp air does the same work.

Plants also help to break up rocks and stones. Everyone has seen rocks split and broken by pipal trees. But every plant, whether moss or grass or creeper, rooted on rocks, gradually eats its way into them and forces apart the small particles of which they are made. Pull off any plant growing on a rock and you will see some of these particles sticking to its roots. Even animals such as worms and ants help in this work.

Soil and Sub-soil.—Now all the forces which do this work of weathering make soil. Rock is thus the mother of soil. Without rocks and without weathering, there could be no soil; the surface of our earth would be bare and hard; no plants could grow and man could not live. But almost every inch of the land of the earth is covered with soil of some kind, and in many places this soil is deep. So we can understand how useful this work of weathering is.

Since weathering takes place in all rocks and since different rocks contain different minerals, the soil made from one kind

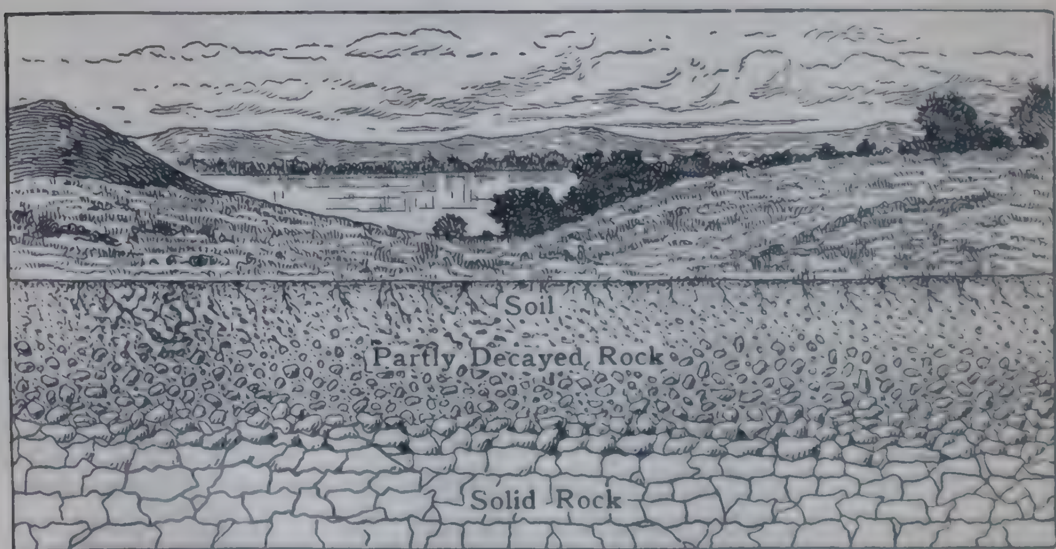

FIG. 43.—Section of the earth's surface.

of rock will differ from that made from another. A granite rock is weathered into one kind of soil, limestone into another, and so on. Almost the whole of India, from the Ganges valley to Cape Comorin, is covered with a kind of gravelly soil

called laterite. This laterite has been made from the crumbling of rocks, which for thousands of years have been heated and dried by the sun's rays every hot season and then cooled and soaked by the monsoon rains. Its reddish colour tells us it contains iron. Another soil made by this kind of weathering is black cotton soil (regur), which covers large parts of the peninsula of India. Some rocks weather into a clay soil, some into a sandy soil.

The soil which man uses for cultivation is the upper portion of finely weathered rock which contains some organic matter, such as decayed leaves and the remains of dead plants and animals. A foot or two below this, we come to the subsoil, which is not so finely powdered and in which there is but little organic matter. This subsoil varies in depth but (except in alluvial soil), it is seldom deeper than about twenty feet, and it gradually gets coarser till we reach the mother rock on which it lies. Fig. 43 shows a section of a cutting into the ground. The topmost soil is fine clay mixed with roots, for here heat and cold, water, wind and plants have been longest at work. Deeper down we gradually come to the subsoil, which is coarser and mixed with broken, half-decayed rock. Lower down still we reach the mother rock. Its surface is half rotten, with cracks in it, and we can break off pieces with our fingers or a knife. Inside it is hard and sound, because there the weathering forces have not yet reached it.

On steep slopes, such as the sides of hills, the soil is not deep, because the particles of rock, when weathered, slip down or are washed off by rain or swept away by wind. That is one reason why we find few fields on hills and mountains. Where the slope is less steep and in level parts, the soil and subsoil are deeper.

There is another and more important soil called Alluvial soil. It is not made from rocks lying underneath it, but is composed of particles of different kinds of rocks, rubbed down and washed together by rivers and streams. (Alluvial is a Latin word meaning "washed together.") The whole of the Indo-Gangetic valley and the valley floors of other large rivers in India and

other countries are covered deep with alluvial soil. If you pick up a handful of soil at Benares, or Cawnpur, or Tanjore, or Rangoon, or on any delta, its particles may have come from a thousand different places and a thousand different rocks, and may have been washed down by a hundred different streams and tributaries. A mixed soil like this is more fertile than soil made from only one kind of rock. In most parts of Rajputana there is no alluvial soil, because there are very few rivers and streams to make it, and even the soil formed from the weathering of rocks is there very thin, for but little rain falls.

Man dwells on the earth digging and ploughing the soil on its surface. But he did not make this soil. It has been made ready for his use by heat and cold, rain and running water. We now go on to study how this work of making soil is done.

CHAPTER XVI.

RUNNING WATER.—THE WORK OF RAIN AND RIVERS.—DENUDATION AND DEPOSITION.

Rain.—One force which changes the earth's surface is that of running water. When rain falls, some of it is turned into water vapour by the sun's heat, some flows off over the surface into a stream and some sinks into the ground. Some of the water that sinks remains there as **underground water.** The greater the amount of rain that falls, the more porous the soil and the rocks under it and the less the slope, the greater is the amount of underground water. There are vast stores of water a few feet under the ground in most parts of the world. Plants send down long roots to find it, and man digs wells to reach it. Where little rain falls, or on hill slopes, wells must be dug deeper than in low-lying places such as valleys. How deep are the wells in your village ?

But some of the underground water does not remain where it sinks. It begins a journey, sometimes long and sometimes

FIG. 44.—Showing a spring bubbling up through a crack between two sets of strata that have been displaced.

short. It may sink deep into the soil or among rocks through cracks. There it wanders about and, after a long time, it may return to the surface at some distant point. If, during its journey, it has sunk deep, it may be hot when it returns and we call it a **hot spring.** There is a sacred hot spring at Gangotri, the source of the Ganges. Hot springs often have minerals, such as iron, dissolved in them, and a bath in these mineral

FIG. 45.—A large hot water Geyser.

springs cures certain diseases. The water is also drunk as medicine. In many parts of India there are sulphurous springs. In some parts of the world, especially near volcanoes, this hot water may spout high into the air with clouds of steam, and we call it a **geyser.**

There are many kinds of springs. After rain sinks deep into the ground, it may come to a sloping rock or bed of clay through which it cannot pass. It follows this slope till the

rock or clay bed comes to the surface, say on the side of a hill. Here the water gushes out as a spring. Sometimes rain sinks deep into a rock through cracks and then comes out by a lower crack. We find such springs at the foot of cliffs. Even in a desert a spring may bubble up and allow grass and trees to grow round it. In some parts of the world springs of fresh water well up from the ocean bottom.

Rain, sinking into the ground, may come to a soft rock, like limestone. By the help of its acids it gradually dissolves this

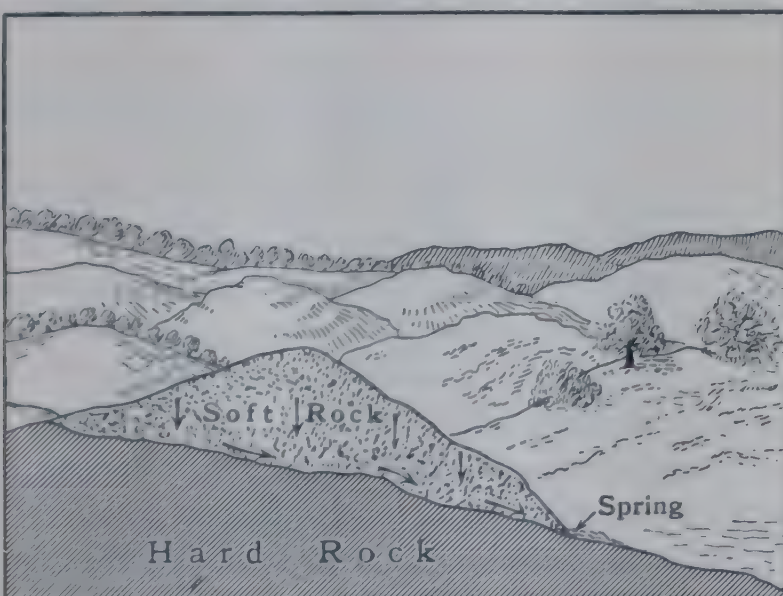

FIG. 46.—Water soaking through soft rock and running along the top of hard rock to form a spring.

rock and hollows out passages through it. Sometimes it wears out holes like a honeycomb. In some parts of the world underground caves, as large as temples, are found with small rivers running through them. On the sides of steep hills and mountains, rain, soaking into the soil, loosens it and makes it slip, and huge masses of earth, stones and rock may slide down the slope into the valley below, burying trees, houses and railway lines. This is called a landslip. Such landslips take place in the Himalayas. If a landslip falls across a river, it may block it up and force it to change its course.

The Work of Rivers.—But we saw that some of the rain does not sink into the soil. It flows over the surface. As

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more rain falls, it forms into small rills. These rills follow the easiest slope. They unite with each other and form a brook. This brook joins another brook and an infant river is born. These brooks and rivers do not flow here and there by chance. They always flow down a slope. We can always tell from a map how the surface of a country slopes by noticing how the rivers flow. The rain-drops, the brooks and the rivers all do the same work. They carry off particles of soil, and in this way the surface of the land is slowly worn away. This work is called **denudation**—a Latin word which means ‘ making naked or bare.’

Rivers carry on this work of denudation in two ways. They dissolve rocks and soil and they rub them down. All water that flows either on the surface or underground contains acids, and these acids do the work of dissolving the minerals of rocks and soil. All running water on the earth is carrying a load of mineral matter. Every river is thus a great drain which sweeps along not only the mineral matter which its own acids dissolve from the rocks and soil over which it flows, but also the mineral matter brought into it by underground water, which flows into it from springs or is poured into it by its tributaries. If the river and its tributaries carry much of these acids and flow over soft rocks, such as limestone, they dissolve the minerals in them quickly. If the rocks are hard like granite, this work is done more slowly. Place a bag full of salt or sugar in the bed of a river. Very soon the water will melt or dissolve the sugar or salt and carry them away, though we cannot see the particles in the water. In the same way, every large river carries to the sea every year a vast quantity of dissolved matter—millions of tons of it. Its water may be clear and we may not see the dissolved matter being carried away, but it is there. Even a small river like the Thames carries to the sea five lakhs of tons of dissolved mineral matter every year. The amount carried by large rivers such as those of India is very much greater. Thus the water of rivers and their feeders, by carrying off mineral matter, lowers the surface of the ground.

Rivers and their feeders do the work of denudation in another way also. They carry off a load of mud, sand and gravel. Some of this is washed into them by rain falling on their banks, some is brought by feeders and some the river itself washes off its banks, especially if these banks are made of loose soil. The force of the current tears and rubs off pieces of soil and particles of rock as it rushes over them. It also uses tools to help it. It drags and rolls along stones which knock and rub against one another and against its banks and its bed. These stones are worn down smooth and round, till at last they are ground down to gravel, sand and clay. We can see smooth stones, gravel and mud in the beds of most rivers. The rocks in the river-bed and its banks are slowly battered down, the soil is washed away and, so, gradually the valley is deepened. Swiftly flowing rivers do this work more quickly than slow-flowing rivers, because they have more force. Mountain streams, where the slope is steep, are able to roll along even large boulders and to use them as hammers to break up smaller stones. In floods all rivers flow more swiftly, and then they have more force to do this work. Then the water is brown and dirty, and full of mud which is being swept away. In a few hours or days of flood the Indus, or Narbada, or Kistna, deepens or wears down its bed more than it can do in the dry months, when the current is slow and the water shallow. If, however, it is sluggish or if its bed and banks are bare and solid, it carries but little sediment.

Now, if the river alone were at work, it would cut its channel straight down as a saw cuts wood, so that its valley would be narrow like a trench. Its valley would have steep straight sides and form a gorge. This seldom happens, because, while the river is doing this work of denudation, the work of weathering is going on on either bank. The rain dissolves the rocks and washes the soil from the banks down into the river, which sweeps it away. Thus the river-banks are not straight, but sloping. Sometimes, however, the river does its work of cutting out its bed much more quickly than the rain can wash

down its banks, and then steep gorges are formed. At one part of its course the Indus has cut its way down through rocks nearly 17,000 feet deep and formed one of the greatest gorges of the world. Where a swift river flows over soft rocks in a dry climate, such gorges are formed. The Colorado river in North America flows for three hundred miles in a gorge, or

FIG. 47.—Gorge formed by river through rocks.

canyon, the walls of which rise in places more than a mile sheer above its bed.

Rivers also broaden their channels and widen their valleys. They do not always remain in the same bed. Almost every river, especially over level ground, wanders about making a new channel for itself. In this way it washes away first one part of its valley and then another, and so broadens and levels it. Any old man who has lived all his life by the banks of an Indian river will tell you of its floods, and how it does not now

flow in exactly the same bed as it did when he was a boy. All valleys are constantly being widened. A good physical map of India, or of other parts of the world, shows clearly how the

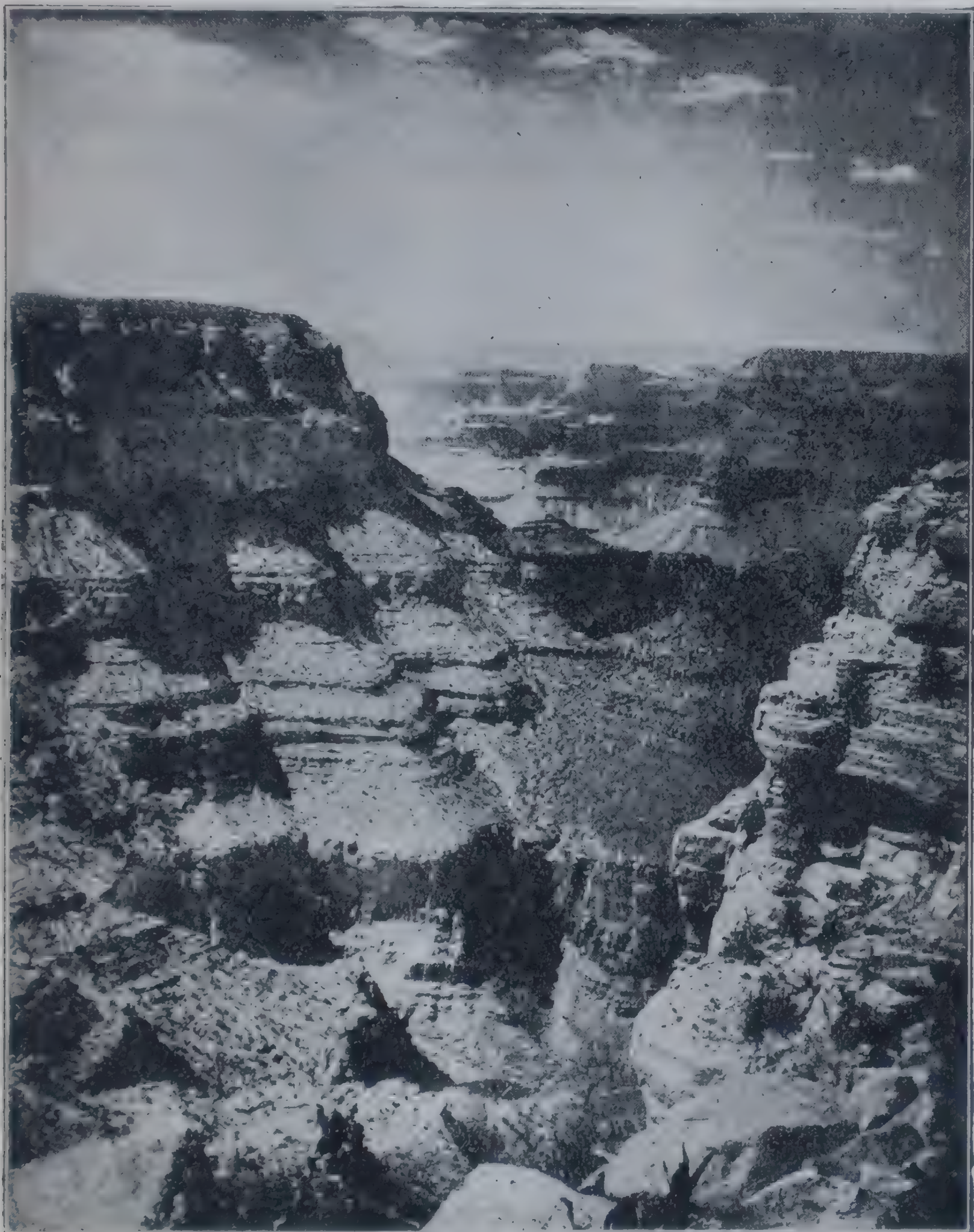


FIG. 48.—The Colorado canyon or gorge.

valleys of rivers, large and small, form hollows over the land leading down to the sea. Along these hollows man makes roads and railways.

Deposition.—And what becomes of the mud and sand carried away by rivers? They not only carry these away from one place, but they lay them down in another. This work is called **Deposition**—a Latin word meaning 'laying down.' The soil, gravel, and even stones of their upper courses are being constantly carried lower down. But they are not carried down to the sea in one journey. There are many stopping places. When the flood is over, the river loses its force. Also,

FIG. 49.—How a river collects water and pours it into the sea.

when it comes to a level part of its course, its current becomes slower and weaker. It has to let its burden of sediment, or silt, fall. This silt settles down to form mud-banks, bars and islands in the river. In floods some of it is spread over the flat banks to form a flood plain. But that is only a stopping place. Sooner or later, when another flood comes, these bars and islands are swept away and the river, by changing its course over its flood-plain, sweeps that away too. All the silt washed away from the upper valley is certain to be carried down to the sea some day. When the river reaches the level land near the sea, its flow is checked; its current has no longer force to carry its load of silt farther. Waves and tides from

the sea may run up its mouth and check it still more. Here, again, it lets fall its silt. Gradually this deposit gets higher, till it reaches the surface of the water and becomes a plain of dry land. As more and more silt is deposited, this plain is built farther and farther into the sea and is called a **delta**. The main river has no longer strength to flow in a single channel over this flat delta, as it does higher up where the slope is

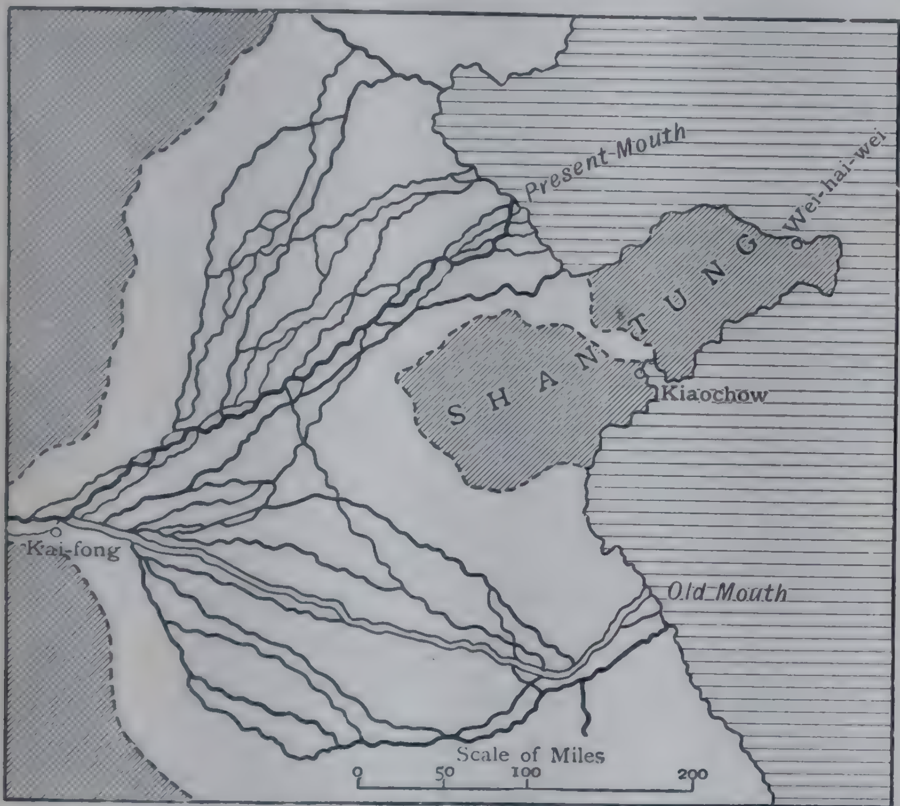


FIG. 50.—How the Yellow River of China has changed its course. Measure the distance between its two mouths.

steeper. It, therefore, splits up into many branches, called distributaries, like the branching ribs of a palm leaf.

Every one who has lived on the deltas of the Indus, the Ganges, or Godavari, has seen how their distributaries constantly change their courses. The great Hughli, on which Calcutta stands, is really a distributary of the Ganges, which leaves it about two hundred miles before the main river reaches the sea. Dredgers are constantly at work to keep the Hughli channel deep enough for ships. If this were not done, the Hughli would get blocked with silt, ships could not reach Calcutta, and this

great port might even be left without any river at all. The Yellow River in China has, when near the sea, more than once changed its course into a new channel many miles away, destroying villages and drowning thousands of people.

Not every river forms a delta. It may not bring down enough mud to do so. Or, if there are strong sea-currents along the coast, they carry off the sediment as fast as the river brings it down. In an inland sea, such as the Caspian or the Mediterranean, there is no tide and but little current, and deltas are formed at the mouths of their rivers. Again, if the sea is very deep opposite the mouth of a river, it takes a very long time to form a delta. Sometimes the floor of the sea at the river-mouth is sinking. In such a case even a very large and muddy river is not able to build up a delta as fast as the bottom sinks.

Glaciers—The Work of Ice.—In cold countries during winter and on the slopes of very high mountains all over the world, the moisture brought by clouds does not fall as rain, but as snow. Snow is just a form of ice. If you take up a handful of it and squeeze it hard, it turns into ice. Now, in places near the poles, or on the tops of the highest mountains, so much snow falls that the heat of the sun cannot melt it. Every year the snow gets deeper and deeper. In this way it is pressed together till it becomes ice. As this sheet of ice slowly slips down the valleys of the mountains, it forms a kind of ice-river, called a glacier. These glaciers glide on, very very slowly, till they reach a warm valley where the heat of the sun and the air is enough to melt them.

Glaciers carry on the work of denudation just as flowing rivers do. These thick heavy sheets of ice glide slowly, scraping along over the mountain valleys, rubbing off pieces of rock and grinding them, as corn is ground in a mill. They carry, frozen in their bottoms, pieces of rock and stones, and these help them to scour down the rocks in their beds, just as (on a small scale), we use sand or sandpaper to take rust off iron. In many parts of the world stones and rocks are found with long scratches on them. This is a proof that these rocks

were once scraped by ice. Besides, pieces of rock dislodged from the mountain sides roll down on to these glaciers and are carried along on their backs. A glacier does not move more than a few feet in a year, and its end, or snout, in a lower valley is always melting. The water pouring out of it forms a stream or river, which carries off the mud and the fragments of rock ground down by the ice. High up in the Himalayas the baby Ganges gushes out of an ice-cave like this, called the Cow's Mouth. Thus glaciers, like rivers, carve out their valleys and carry away the stuff they have scraped off their sides and off their beds (see pp. 415 and 431).

In India, at the present day, the high valleys of the Himalayas are being worn down in this way. The highest slopes of these mountains are the gathering places of snow which feed many glaciers.* The glaciers of the Karakoram Range are the largest in the world. But, long ago, much more snow fell on these mountains, and there were many more and larger glaciers than there are now. A great deal of the deep soil of the Indo-Gangetic valley has been scraped by ice from the slopes of the distant Himalayas and been washed down by rivers. The mud formed by glaciers grinding down rocks is called **till**.

In Greenland a huge glacier covers an area about one-third the size of India, and the ice is more than a mile thick—in some places over four miles thick. This vast ice-sheet is always slipping down to the coast. There its edges break off, and huge masses of ice, called icebergs, float off into the sea. They are sometimes a mile in length and higher than the highest temple. Only a very small part of them is seen above water. They drift for hundreds of miles over the ocean till they melt and disappear. Long ago the whole of Canada and a large part of Northern Europe were covered with ice as Greenland is to-day. We know this by the marks of ice left on stones and rocks.

* The Mt. Everest Expeditions of 1921, '22 and '24 brought back some wonderful photographs of the vast glaciers and snowfields round that mountain.

The Work of the Sea.—When the wind blows strongly, it raises huge waves which dash against the shore with great force. These waves carry on the work of denudation along the coasts just as rivers do on land. The acids in sea-water eat away the rocks and the waves roll them into pebbles and then into sand. On every beach we can see this work going on. Waves cut out caves under cliffs and wash away their bases and huge lumps of rock topple over into the sea. The

FIG. 51.—Rocky cliffs eroded by the waves.

cliffs on some parts of the coast of England are made of chalk, a soft rock, and here the waves have destroyed large parts of them. In fierce storms the force of the waves is terrific. The broad stone arms of Madras harbour have twice been smashed to pieces in cyclones. But, just like rivers, the sea carries on the work of deposition too. It does this by its tides and currents, which sweep away the sand and shingle from one part of the shore and lay them down at another. In this way the coast line is made more regular. In some places the

currents sweep the sand together and form bars along the coasts and at the mouths of rivers. Boys at Madras now play football on ground over which, not many years ago, the sea flowed.

All along the coasts of India the work of denudation and deposition is going on. Before an engineer makes a harbour he must first study the sea-currents. If he does not do so, he may find, too late, he has built his harbour at a place where currents sweep in and deposit sand, so that in a few years the harbour will be filled up and useless. At Bombay, Madras, and other places dredgers are always at work scooping up sand washed into the harbour, and keeping it deep enough for large vessels to float.

The Work of Wind.—Air is the brother of water. It helps on the work of denudation and deposition. Moving air, or wind, gives force to waves on lakes and on the sea. On land it blows the tiny particles of rocks, soil and sand hither and thither and spreads them about. In countries like India where, in most parts, plenty of rain falls, the ground is damp enough to let plants grow and cover it, so that the wind cannot catch up the particles of soil and whirl them away. So, perhaps, we may think the work of wind is not important. But on the tops of mountains where the wind blows fiercely, and where it is too cold for many plants to grow, the wind does a great deal of work in carrying off the tiny particles of crumbling rock. The same thing happens in dry, bare, desert lands where there are but few plants to protect the soil. Here, whenever the wind blows, the soil on the surface is in motion, clouds of dust fill the air and blinding storms of sand sweep over the country. The wind picks up the particles of soil, whirls them away and lays them down in heaps, now here, now there.

If we visited the Thar or Rajputana Desert, a vast expanse about 40,000 sq. miles in extent, we should easily learn how wind changes the surface of the land. Here, for long ages, very little rain has fallen and so, during these ages, the wind has been able to do what it liked. Everywhere we see a waste

of sand, with bare rocks sticking up here and there. This sand is not perfectly flat, for the wind has blown it into great ridges and hillocks like waves of the sea. These ridges are being slowly moved farther inland, one behind the other. Where did this sand come from? Some of it was made by the weathering of the rocks of the desert. The heat of the sun is very great during the day, but at night the temperature often

Siebenthal, U.S Geol. Survey.

FIG. 52.—Ridges of sand formed by the wind.

falls by 100° Fah. This constant change from hot to cool has made the surface of the rocks crumble. The wind, by blowing the sharp particles of sand against the rocks, scrapes them down still more. But much of the sand of this desert has been carried into it from outside. For six months, during the monsoon season, the wind blows from the sandy coasts of Cutch in the south-west. This monsoon wind, every day it blows, carries particles of this sea-sand and lays it down in the desert. Some of the sand has also been blown in from the basin of the Indus in the west. In this way the wind has filled

up with sand the river-beds which, hundreds of years ago, carried the water of the Indus into the Rann of Cutch. There is a danger that this drifting sand may slowly bury some of the towns of Rajputana.

But that is not all. Everyone has heard of the deposits of salt in Rajputana. This salt has been carried in from the distant sea coast. Every year as much salt is borne by the wind into Rajputana as two lakhs of bullocks could drag. All along the coasts of India the wind has blown the sand into ridges called sand-dunes. In some places it carries it into fields and destroys them, so that trees have to be planted along the shore to check it. On the Malabar coast these wind-formed sand-dunes have blocked up the mouths of rivers and formed many lagoons or back-waters. The same thing has happened on the coasts of Ceylon and other countries. Along broad river-beds, such as those of the Ganges and Godavari, the wind during the dry season heaps up sand. In the north-west of the Punjab, beyond the Indus, on the slopes of the Salt range and in parts of Baluchistan there are thick deposits of dusty earth called **loess.** It has been carried there from the hot dry plains and dried-up river-beds by the great dust storms of the hot season year after year. Such is the work of wind in India. It does the same kind of work in other parts of the world. In dry places, such as the Sahara Desert in Africa and the Gobi Desert in Asia, great waves of sand are heaped up which the wind is constantly moving here and there. In the north of China, the prevailing winds blowing from the sandy steppes of Central Asia have covered the hills and filled up the valleys with deposits of loess many hundreds of feet thick. Some of it has been blown into the Yellow Sea, which has thus been made shallower.

CHAPTER XVII.

HOW SECONDARY ROCKS WERE FORMED.

WE have now studied the great forces which have changed and shaped the surface of our globe. These forces are of two kinds: 1. Earth-movements, *i.e.* building or structural forces acting from within the crust; 2. Denudation and Deposition, *i.e.* moulding forces acting on the surface. The forces have been at work together for longer ages than we can imagine, changing the face of the earth. The rough work of shaping has been done by movements in the interior of the earth, raising and lowering, bending, folding or twisting. The more detailed work has been done by water and wind, heat and cold (frost).

In Chapter XIV. we saw how the crust of our globe cooled into hard rock, and that this rock formed the deep floor of the earth on which we live. But on this floor other quite different rocks have been formed and built up in quite a different way. They have been formed by denudation and deposition, by the wearing down of primary rocks and they are called **Secondary** or **Sedimentary Rocks.** (Sedimentary is a Latin word which means 'laying or setting down'). Most of them have been slowly, bit by bit, built up in shallow seas. We have learned how the work of deposition goes on at the present day. It has been going on ever since there was running water on our globe. During uncounted ages rivers poured into ancient seas (just as the Ganges and a hundred other rivers are doing to-day), the silt and sediment they washed off the dry land. Near the shore they deposited gravel and stones; the lighter mud and sand and lime they carried farther out to sea. One river

carried down one kind of silt ; another carried down another. All this was spread over the sea-bottom. Slowly the floors of seas near their shores were covered with beds of stones, of gravel, of sand, mud and lime.

Perhaps the floors of some seas might be gradually sinking all this time. Thus the deposits on them might be spread thicker and thicker and yet not rise any nearer the surface of the water. These deposits were in many places thousands of feet thick, but they were laid down slowly and regularly. The great weight of the upper layers and of the sea above them pressed down the lower layers, and slowly squeezed them till they became solid rock. This hardening was sometimes helped by the lime and iron dissolved in the water which bound them together, as we use lime to bind stones together in building. All this went on for ages, at the bottom of shallow seas. Then a change might take place. Owing to some earth-movement the force of a river might become greater or less. If its slope was made steeper, its force would be increased ; if its slope was made more level, its force would be lessened. It might now lay down mud where before it laid down gravel, or lime instead of sand or clay. The top layers might thus be different from the lower ones. There might be a bed of clay, then one of gravel mixed with lime, then one of clay full of stones, then sand mixed with iron, then perhaps pure clay again. Gradually they were all squeezed and hardened into rock.

Then another change might take place owing to some earth-movement. The whole sea-bottom, made up of these beds, would be slowly raised to form dry land. Over it rivers would flow and wear it down into valleys and plains during long ages. In marshy places, after plants began to grow on the earth, moss and forests of palms, bamboos and ferns would spring up and form dense jungles. When these trees and plants died and fell into the marshes, they formed a thick bed of vegetable matter. Then slowly the land might sink again and become the floor of another sea. Once more the work of deposition would go on. Rivers would carry off the waste of the land,

pour it into the sea and spread it over this floor. New layers of sand, of mud or of gravel would be deposited and pressed hard to form rock. The old forest would be squeezed into a layer, perhaps five or ten feet thick, and would be turned into what we now call coal. Above it would be beds of sandstone or limestone or hard clay rock mixed with stones. Perhaps on top there might be a layer of shells and lime pressed and hardened into chalk. Once more the land would be raised above the sea, stay there for thousands of years, then sink again, then rise again.

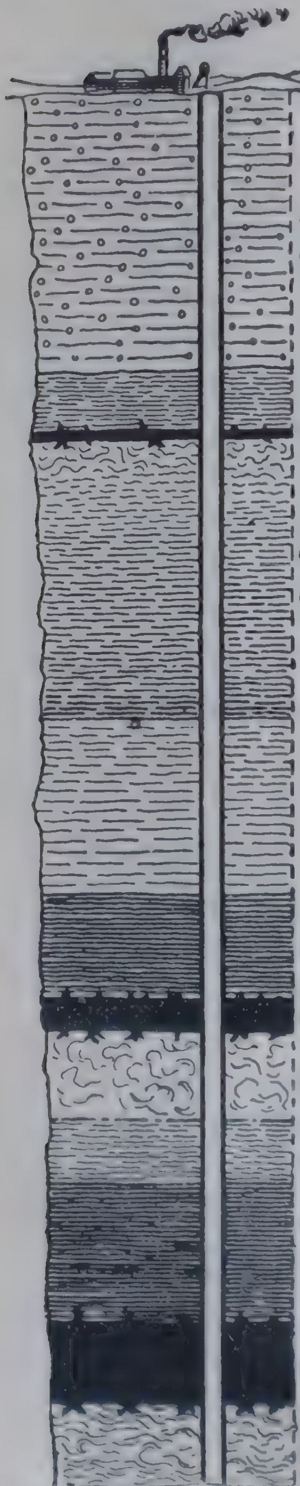


FIG. 53.—Shaft of a coal-mine sunk through layers of clay, rock and coal.

In Fig. 53 we see the section of a coal mine. The beds of coal are shown by black bands lying between beds of stratified or sedimentary rock. These coal-beds were formed at different times, the lowest bed being, of course, formed first. When the coal-beds were formed, the surface was above the sea; when the other beds were formed it was under the sea. Thus, to form this section of the earth's crust, it must have sunk at least three separate times beneath the sea. By the regularity of the beds we can see they have not been bent or twisted. They were simply raised and sunk. It is difficult to tell the story of these sedi-

mentary rocks in a few lines for it went on for millions of years. A single layer of coal, or sandstone, or clay rock may mean a lakh of years of the world's history. The lowest bed of coal in the picture was probably formed millions of years before the uppermost one.

Petroleum or mineral oil is also found deep down in sand beds and sandstone rocks. Pipes are sunk to reach it. Owing to its pressure it often rushes up these pipes with force enough to make it spout a hundred feet into the air. Natural gas usually comes with it. It is believed that this oil is derived

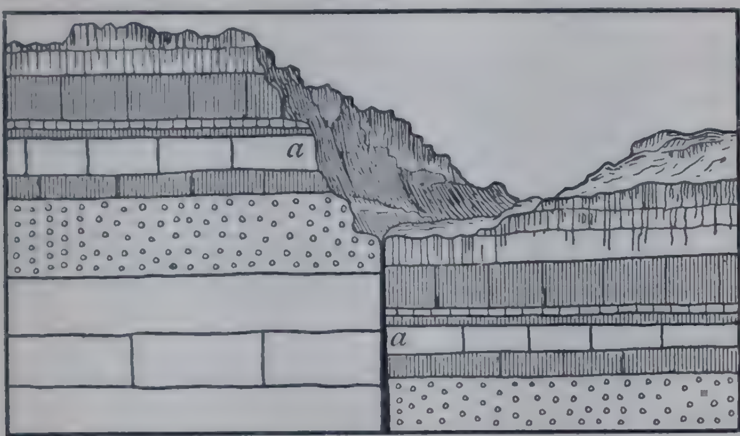


FIG. 54.—Showing layers of rock displaced by forces from beneath.

from decayed animal and vegetable matter entombed in sedimentary rocks when they were formed. Our chief oil wells are in Burma.

We can now picture in our minds how the earth's crust has been shaped through immense periods of time. First, as the earth cooled, a thick crust of hard primary rocks was formed all over its surface. This surface was not smooth but heaved up into mountains and sunk down into hollows over and over again. The molten rock beneath often welled up through this floor of rock and poured over it, making new heights and filling up old hollows. At last, as the earth's crust cooled deeper and deeper down, the rock floor of our globe, with its heights and hollows became more and more fixed. Only now and then was its level altered a little up and down, here and there. Only in a few volcanoes did the melted rock burst up through

the surface. That was, it is believed, the first part of the long story of the earth.

Then began the second part. By this time the earth's surface was cool enough to allow water to lie on it, and flow over it. The atmosphere now enclosed it all round. Rain and running water, blowing winds, heat and cold now began to do their work. Weathering, denudation and deposition went on without ceasing for long ages. The surface of the old primary rocks was weathered and worn down. Their waste was swept into seas to form a new kind of rock, which we call secondary or sedimentary or stratified, because they were laid down evenly in layers or strata like the pages of a book, one on top of the other. Earth-movements lifted these layers to form dry land and sank them again to be the floors of seas, over and over again through millions of years. Sometimes they were lifted straight up and formed level beds of rock as we see in Fig. 54. Sometimes they were twisted in all sorts of ways as we see in Figs. 54 A, B, C.

The earth, as it went on cooling, contracted, so that its surface of rocks was pulled together and folded into hills and valleys. Sometimes molten matter from beneath would force its way up and bulge out or burst through the crust of sedimentary rocks. If it burst through, it cooled into a rock we call granite. The intense heat of this molten matter bursting into or through the sedimentary rocks would change them. Rocks formed of mud would become slate, lime rocks would be hardened into marble. Such sedimentary rocks would be so heated that they might melt and, on cooling, would be crystallised, just as, if we boil cane juice, it cools into a crystallised substance which we call sugar. Volcanoes, too, would be found pouring out lava round the vents they made in the surface.

But all this time the work of weathering, denudation and deposition was going on, without stopping for a moment, as it is going on to-day. Now they acted on the secondary rocks which they themselves had made, just as at first they acted on the primary rocks made by the cooling crust. Rocks

formed by deposition at the bottom of seas were raised up, worn down again by heat, cold, wind and rain, swept by rivers into new seas to be laid down as new rocks and then to be lifted up and worn down once more—over and over again.

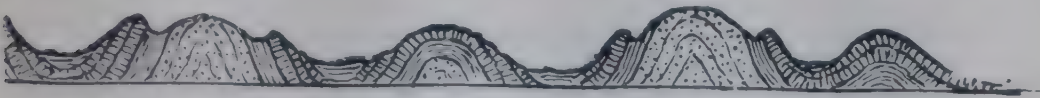


FIG. 54A.—Hills and valleys formed by the folding of secondary rocks. In two places the tops of these folds have been worn off by denudation.

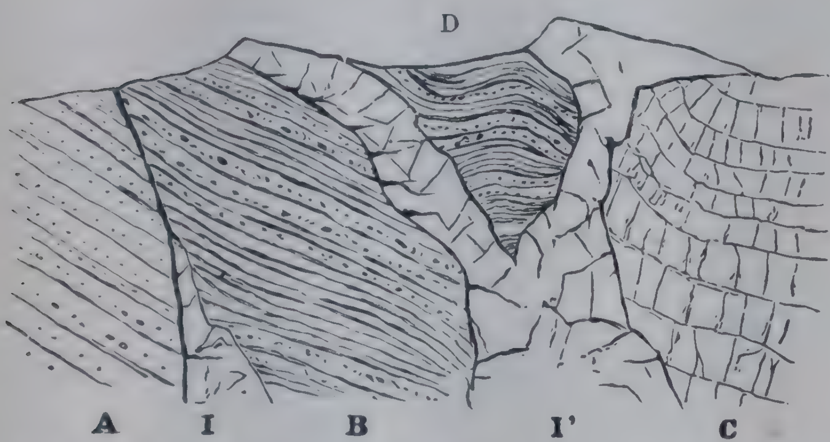


FIG. 54 B.—A, B, C, D are sedimentary rocks. I and I' are igneous rocks which, from below, have been thrust through (I') or into (I) these stratified rocks.

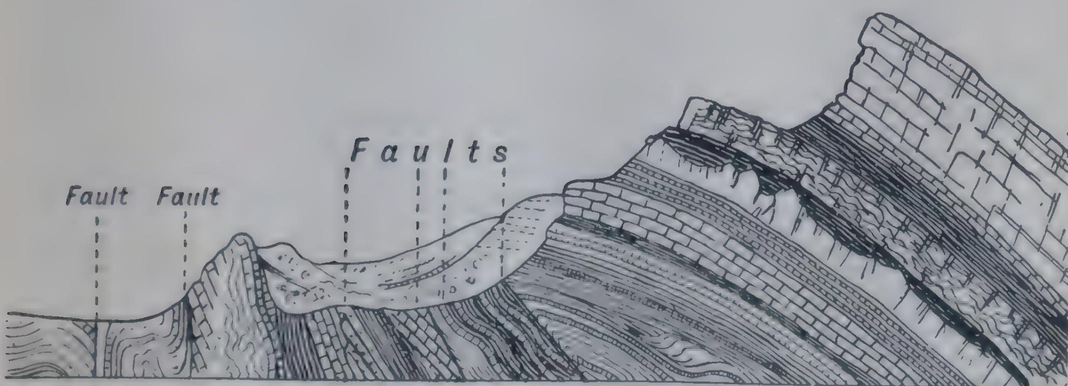


FIG. 54C.—Section of rocks near the Indus showing how stratified rocks have been tilted up. A fault is a place where rocks have slipped down or been thrust up from below.

For millions of years this work of building up secondary rocks and wearing them down again has been going on. We can see it all round us to-day. It took a long time to prepare the earth as a home for man.

CHAPTER XVIII.

LAND AND WATER FORMS.

HAVING seen how the forces worked that shaped the crust of the earth, we can now study the chief land and water forms.

Plains.—Level or gently sloping parts of the earth's surface are called Plains. There are plains, large or small, on all the continents. In Asia, Europe, North and South America they are very wide and many towns are built on them. Large parts of the floors of oceans are flat plains.

River Plains.—Some plains have been formed by rivers and they are often called Flood Plains. Even on a road, after rain has fallen, we may notice places where the running water has spread some mud over a hollow and filled it up. In the same way rivers, when in flood, overflow their banks and spread out in a sheet of water over the bordering lands, sometimes right up to the edge of their valleys. The water rushing along the bed of the river is swift and strong, but the current flooding the bordering land is slow and, therefore, the mud which it carries sinks. If there are frequent floods in a river, if it brings down plenty of mud and if its feeders do the same, it gradually builds up a flat plain on either side. The heavier the rainfall in its basin, the more water does the river use to do this work. The more level and shallow the bed of the river is, the more easily does it flood its banks.

Again, a river after it has begun to form a flood plain does not always remain in the same bed. It may break over its banks and form a new channel for itself. It thus wanders in great curves over the plain it has already built, carrying mud with it and spreading it on either side. In this way, after

long ages, it may visit every part of its flood plain, raising it and levelling it. Its feeders do the same kind of work.

Many of the great plains of the world have been formed like this. For example, the great Indo-Gangetic Plain is a flood plain of this kind. It is believed that, when the Himalayas were folded up, a great hollow was made between them and the Deccan table-land. Into this hollow immense quantities of sand, mud and silt have been washed during thousands of years, till it is now filled up and nearly level. The Himalayas receive very heavy rainfall, and the three large and hundreds of smaller rivers coming from them flow down steep slopes. In the rainy season, therefore, they quickly fill with water and

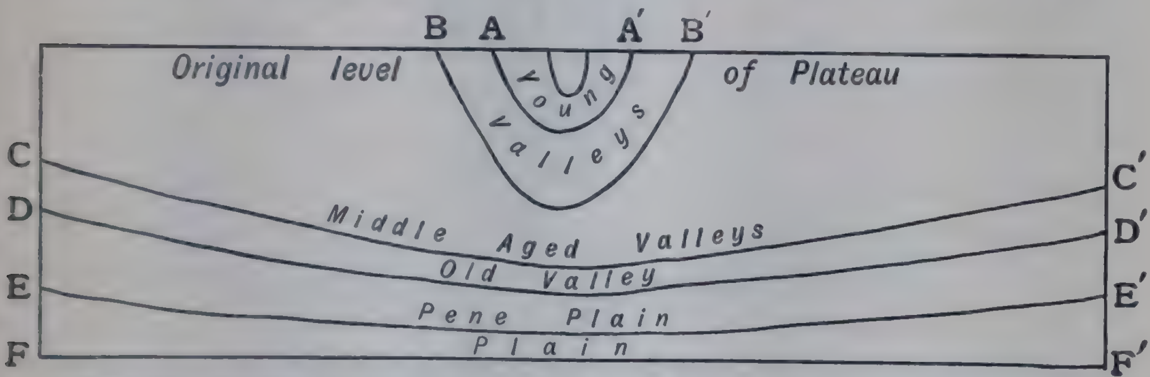


FIG. 55.—Section showing how valleys are deepened, widened and flattened.

rush down to the lower level very swiftly, so that they can carry a great deal of silt and spread it over their banks. The rivers flowing into this hollow from the Deccan, *e.g.* the Son and Chambal, receive less rain, and they are not nearly so steep, so that they bring less mud. During long ages all these rivers and their feeders have wandered about different parts of the great plain raising and levelling them one after another. All over it we find their old dried-up channels. The more level the plain became, the more slowly the rivers flowed and the more easily they wandered over it. The Indo-Gangetic plain is thus a wide and deep trough which has been filled up and levelled nearly flat by the work of rivers. The soil in this plain is very deep—in many places hundreds of feet deep. This tells us it must have taken a very long time—perhaps a million years or more—for the rivers to do their work and

prepare it as a home for the lakhs and lakhs of people who now dwell on it. And this work is not yet finished : it is still going on. Thus the Ganges delta is year by year being built farther

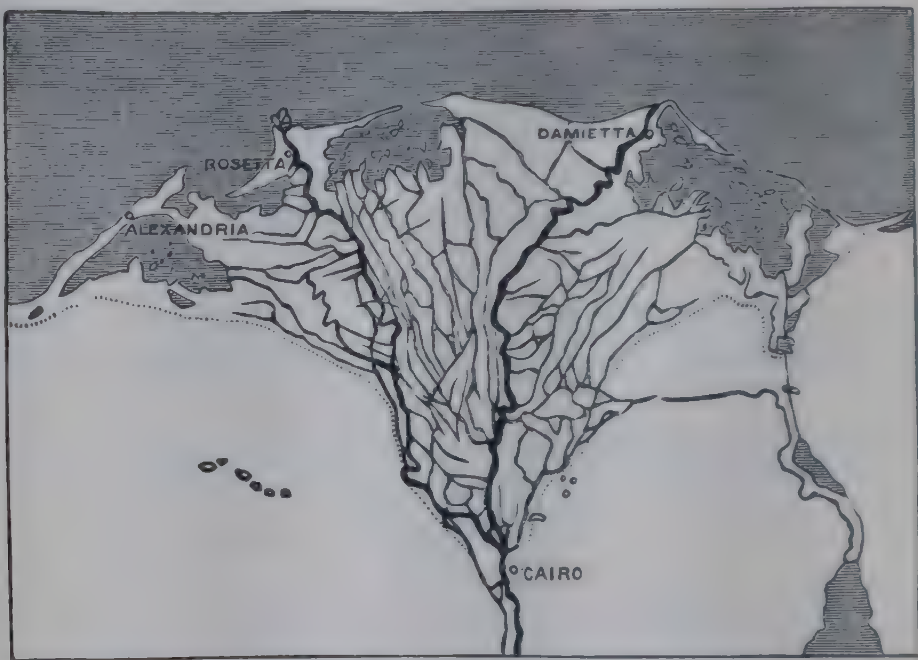


FIG. 56.—The delta of the Nile, showing its distributaries.

and farther out into the Bay of Bengal. Deltas are just a kind of flood plain, but they have been formed not by rivers alone, but by rivers and waves and currents of the sea.

Glacial Plains.—Other plains have been formed by ice. In some parts of the world, long ago, great thick sheets of ice spread over parts of the earth's surface. As they slowly slipped along the slopes of the land, they scraped the rocks and soil beneath them, smoothing and levelling them. Where they melted, the stones and mud frozen in them were deposited and filled up hollows, covering the ground with a kind of earth-flour called till. The water of the melting ice, as it flowed, helped in this work of levelling. The plains of Canada, called Prairies, were formed in this way. So was the great plain that lies in the north of Europe.

Lake-formed Plains.—A river flowing into a lake may gradually fill it up with silt ; the lake may dry up and a flat plain be left. Sometimes the lake may be turned into a shallow marsh. The Kolar Lake in India is being gradually filled up

in this way. Many parts of the level prairies of Canada are just the bottoms of old lakes.

Along the coasts of most continents there is a shallow platform or shelf stretching out from the land under the sea. These platforms have been formed by the waste from the dry land. Rivers wash down mud and pour it into the sea. There tides and currents sweep it along and spread it over the sea-bottom. Gradually a shallow shelf is built up all along the coast. In some parts of the world this floor is gradually built up till it rises above the water and forms a coastal plain. In other places an earth-movement has raised the platform above sea-level, and it forms a plain added to the old coast. Thus the coast strip along the Bay of Bengal, which we call the Coromandel coast, has been partly formed by the raising of the shallow bed of the sea. We can see this by digging into it and finding sea-shells and the remains of sea animals.

Lava Plains.—In a few places lava, welling up from creeks in the earth or flowing from volcanoes, has spread over the surface and formed a plain. The Colombia river in North America flows over a plain formed like this, where the molten lava has filled up valleys and even buried mountains. The table-land of the Deccan was, as we learned, formed in the same way. So was the lava plateau of the island of Iceland.

Mountains.—These have been formed in various ways. Most of them have been shaped by great earth-movements. We have learned, for example, that some, like the Nilgiris and Anaimalais, are made of solid primary rock which was the original surface of the world as it cooled. Such mountains are the oldest in the world. Most mountains, however, are built of secondary rocks. When these rocks were first formed, they lay in flat horizontal layers or strata. But some great force from beneath arched them up or bent them, or perhaps the shrinking of the earth's crust has crumpled them, as the skin of a mango wrinkles when it dries. Thus, long ridges or ranges were formed with slopes on either side. Often these folds are double or treble, one behind the other, so that deep valleys are formed between the ranges. The Himalayas, and

the Alps in Europe, have been formed like this. By digging into them we find the layers of sedimentary rock have been arched up or folded to form their slopes. You can make a tiny range or ranges of Himalayas on the back of your hand by pushing the loose skin into folds with your finger. The front part of the first fold of skin is steep. The southern edge of the real Himalayas is also steep. It rises suddenly from the Indo-Gangetic plain. Some great force (stronger than your finger !) thrusting from the north, or Tibetan side, raised the old surface into fold after fold of mighty mountains. By examining the rocks forming the slopes of the Himalayas, we see they were once the floor of an ancient sea. That is the rough framework of many mountain ranges. But then the folded strata forming a mountain have in many places broken and cracked, just as if a piece of cardboard is folded it often cracks and breaks. Then one broken edge may slip out of place, so that one side of the range may remain gently sloping or rounded and the other may be steep. This can best be understood from pictures. (Figs. 54 A, B and C.)

The surface of mountains is moulded by other forces. The peak of a mountain may be bare because the rain and winds beating on it have carried away the weathered parts of the rocks. Lower down, its shoulders are covered with soil which is just weathered rock. Perhaps grass, jungle or forest has grown on this soil and covered its slopes. With their roots they bind the soil together and prevent it being quickly washed away. But nothing can altogether stop the work of wind and water, heat and frost. If no rain falls, so that no plants can grow, then winds carry off the soil and leave its sides bare and rocky ; if much rain falls, torrents will pour down its sides, carrying off soil and rubbing down rocks into stones, stones into pebbles and pebbles into sand and mud. If the higher slopes are covered with snow, large masses of this snow may slip down in **Avalanches** and sweep away trees, rocks and earth. If this snow turns into ice in the valleys, then glaciers are formed which, as we learned, slowly grind down rocks and scrape away the soil over which they slip. Pieces of rock,

broken off by weathering or split up by water freezing in their cracks, roll down the slopes or crash into the plains and valleys below. Earth-movements have raised up mountains. These other forces are slowly wearing them down.

Table-lands (or plateaus) are so called, not because they are flat like a table, but because they are raised above the level of the surrounding ground and because their tops are more or less level. They have been formed in various ways. Some are old parts of plains which have been lifted up or which have been left standing while the land surrounding them has been denuded and lowered. Others, like the Deccan table-land, have been built up by floods of lava.

When a table-land is being worn down, slopes are formed very like the sides of mountains. Weathering goes on both on the top and on the sides of a table-land. If a table-land is formed of layers of rock some soft and some hard, when the soft upper layers have been worn off, the flat hard layer below may remain for a long time and the surface will then be level like a table. Meanwhile weathering and denudation go on along the sides of the table-land and form cliffs and slopes. As these slopes are worn farther and farther back, they may meet, and the old table-land becomes a mountain or a ridge of hills. Table-lands, like mountains, are moulded by the work of rain and rivers. A good physical map of India shows how the Mahanadi, Godavari, Kistna and other rivers have worn out valleys across the Deccan table-land. The parts left standing are high and look like mountains when viewed from the valleys. They are often called mountains. The Western Ghats are mountains of this kind. They are certainly not folded mountains like the Himalayas, for the rocks in them are not bent and arched. They are made of flat-lying beds of lava. Valleys have been worn into these beds and the parts left standing like steep, square-cut stairs or terraces we call ghats. Properly speaking, they are not mountains, but the worn-down edges of the table-land. They are quite unlike mountains of primary rock, such as the Nilgiris, Anaimalais and Travancore Hills, which we also (by mistake) call ghats. We sometimes speak of the

Eastern Ghats as a range of mountains, but they are not. They are really the edges of the Deccan table-land, worn down during millions of years by rain and rivers. Their tops are flat, which tells us they formed long ago part of the table-land.

Volcanoes.—A volcano is another kind of mountain built up of ashes and the molten rock we call lava. Through great holes or cracks in the earth's surface this lava, mixed with steam and ashes, is vomited out. As the lava comes into the

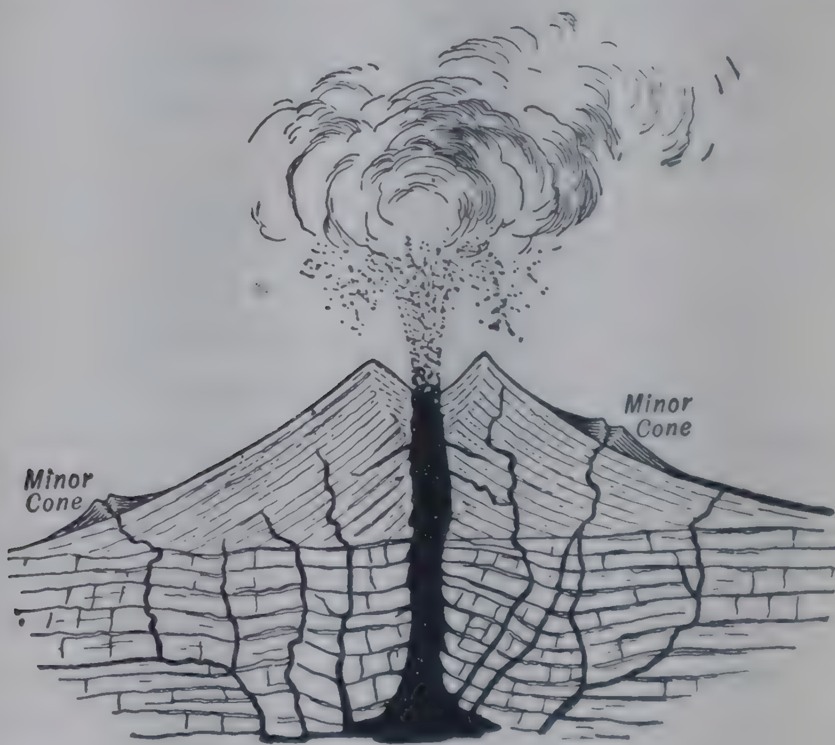


FIG. 57.—Section of a volcano.

cool air, it slowly turns into solid rock. Gradually, as more and more comes pouring out, a hill, shaped like a cone, is formed with a cap-like hollow or mouth at the top called a crater. If this goes on for a long time, the hill becomes a mountain often thousands of feet high. A volcano may even be built up from the bottom of the sea. Fig. 57 is a picture of what the inside of a volcano would look like if we cut away one half of it. The thick dark part is the vent, or chimney, which has pierced the crust of the earth. Up this vent the lava rushes and pours down the sloping sides. The force of the rushing lava is often so great that it cannot all get out by the main

FIG. 58.—Chief volcanoes of the world marked by black dots.

chimney. It bursts its way through smaller cracks on either side of the cone and forms minor cones on its surface. There are more than 300 volcanoes on the globe which are still active,

i.e. they burst out now and then, but there are thousands of dead ones. Fig. 58 shows how the active volcanoes of the world are distributed. A very marked belt of volcanoes nearly encircles the Pacific Ocean as with a girdle of steaming vents. We may say this belt begins with volcanic islands south of South America, and includes the many vents in the Andes of South America and in the mountains of Central America and Mexico. There are many volcanoes in the Rocky Mountains of North America, but they are all, or nearly all, dead. The belt is seen again in Alaska peninsula and the line of Aleutian Islands. On the western side of the Pacific the belt includes the many active vents along Kamchatka peninsula, the Kurile or Smoky Islands, Korea, Japan, Formosa, New Guinea, the Philippine Islands, New Hebrides, New Zealand and Mount Erebus, a volcano on the Antarctic Continent. An offshoot from this belt includes the volcanoes in Java, Sumatra, and the Sunda Islands. We might continue it up to Burma, where there are some mud volcanoes. The volcanoes of the West Indies are by some considered as an eastern branch of the same belt. Outside this belt volcanoes are found on the shores of the Mediterranean Sea.

Most volcanoes are in the sea or near it. Many are on ridges on the ocean floor or on ridges which rise above the sea, *e.g.* the volcanoes of the West Indies. It is supposed that they are chiefly found on lands which have recently been raised or sunk, and where the earth's crust is weak, or perhaps thin.* Thus, there is a line of volcanoes along the rift valley in Africa. This valley has sunk and now contains great lakes. Perhaps the volcanoes of Kilimanjaro and Kenya burst out when this valley sank.

SOME FAMOUS VOLCANOES.—**Vesuvius**, on the west coast of Italy, is the best known volcano. In 79 A.D. the first explosion, which historians have described, took place. Half the rim of the crater was blown off. Its rocks were burst into dust and ashes, which fell on the fields

* It is on or near the volcano-belts of the world that earthquakes most often take place.

round and destroyed all the plants and crops. A city near the foot of the mountain was buried deep in this dust and about 2000 people were killed. Since then several eruptions have taken place, when the red-hot lava overflowed its slopes, and great clouds of steam, masses of dust and molten rock were hurled into the air, destroying plants and killing hundreds of people.

North of Sicily lies the small island of **Stromboli**, which can be seen by passengers on the mail steamers going from Bombay to London across the Mediterranean Sea. It is really the cone of a volcano built up from the floor of this sea. Near the top of the cone there is an opening from which steam constantly escapes. If we are brave enough to climb to the edge of the crater, we see its floor is of black hardened lava, with deep cracks in which the red-hot lava boils and bubbles. At night the glow from this lava lights up the clouds of steam hovering over the mountain, and they can thus be seen for miles over the sea. Stromboli has been called "the lighthouse of the Mediterranean.", **Etna,** on the shores of Sicily, is another large volcano formed of lava and ashes.

One of the most awful explosions ever known took place in 1883 in **Krakatoa**, a small volcanic island, in a strait between Sumatra and Java. Nearly the whole of this island was blown away in a single day, and the sea is now 1000 feet deep where the centre of the island stood. Enormous waves were formed and spread as far as Cape Horn. A wave of water, 50 feet high, rushed over the shores of the neighbouring islands, destroying nearly 300 villages and drowning 36,000 people. The sound of the explosion was heard in Southern Australia, over 2000 miles away.

The volcano of **Mount Pelée** is on the island of Martinique, one of the West Indies. During the early months of 1902 steam was seen rising from the crater and ashes were thrown hundreds of feet into the air, but in this case no lava poured out. New vents appeared in the old crater, sulphurous vapour rushing out of them. Hot liquid mud poured over its slopes and flowed down a valley, destroying everything in its course.

Violent earthquakes were felt week after week. At last, one day in May, a heavy black cloud of sulphurous vapour mixed with dust, intensely hot, burst from the crater and passed over the island. In two minutes it struck the town of St. Pierre. In an instant the city was blotted out, every building being

FIG. 59.—Volcano vomiting out ashes and poisonous smoke.

knocked to pieces or burnt to ashes. Only two of its 30,000 inhabitants were left alive. A day or two later another volcano, on the island of St. Vincent, ninety miles south of Martinique, burst out and destroyed fields and villages for miles around.

Perhaps the greatest volcanoes of our world are the Hawaiian Islands, in the middle of the Pacific Ocean. These islands are

just the peaks of a chain of volcanoes rising out of the depths of the sea. Hawaii is an island built of lava. Its base rests on the ocean bottom, 16,000 feet deep, and it rises 14,000 feet above sea-level, so that, measured from its base, it is higher than Mount Everest. It is made up of three huge volcanoes only one of which is still active.

These are only a few stories of volcanoes and earthquakes. There are many more about other volcanoes in other parts of the world. They give us an idea of the stupendous forces imprisoned beneath the earth's surface, and they tell us how these forces have shaped its crust. At one time there were many more volcanoes. Whole ranges of mountains, such as the Andes, are made up of them. But, now that our globe has cooled for millions of years, most of them are asleep or dead.

Valleys.—Many valleys have been shaped by earth-movements. Thus, when two parallel ranges of hills have been folded or arched up, a hollow has been formed between them. Along this hollow a stream or river may flow. The valley of Kashmir has been formed in this way. Again, in some parts of the world a long hollow or rift has been formed by the surface of the earth sinking. This is called a Rift Valley. But most valleys in India and in other parts of the world have been carved out by rivers and their tributaries, as we have learned.

Swift rivers cut their valleys deeper, but many rivers lay down more sediment than they carry away, and so make their valleys flatter. Many rivers deepen their valleys in their upper courses, where their waters flow swiftly, while they make them shallower in their lower courses, where their currents are sluggish. A river runs swiftly where its channel has a steep slope. But, as a stream gradually deepens its valley, the slope of its channel becomes flatter and the current flows more and more slowly. As time goes on, every river will cut its channel down until its current becomes sluggish. We can often tell whether a river is old by noticing whether its stream is swift over a steep course and down a narrow valley, or slow over a gently sloping course and along a wide valley. Thus the rivers of the peninsula of India, such as the Godavari, Kistna and

Kavari, are older than those flowing from the Himalayas, because their courses are much flatter. Their work of deepen-

FIG. 60.—The river has nearly flattened its valley.

ing their channels and widening their valleys is nearly finished. They can scarcely be made any deeper or wider. The work of rivers coming down the Himalayas is not nearly half done.

FIG. 61.—The river has turned its valley into a plain.

Two neighbouring rivers may broaden their valleys until the high land or water-parting between them is worn away altogether, and thus two river basins become one. The wide valleys of the rivers of the Indian peninsula, such as that of the Tungabhadra, tell us they must be very old. The oldest valleys are those which are flattest and widest. This is another proof that the Deccan is a much older part of India than the Himalayas.

Sea-coasts.—Here all the shaping forces have been at work. On p. 169 we saw how weathering and denudation are carried on along the shores of oceans and seas. Waves, tides, and currents are constantly at work. Waves in storms batter down the rocks by their own force, and by the blows of the stones which they roll against them. They wear out caves under cliffs, and cause huge pieces to fall into the sea. Where the rocks are hard, this work is slower than where they are soft. Waves may eat away soft cliffs and leave a wide bay with hard cliffs jutting out into the sea, here and there. Then the waves roll the broken pieces of rock against one another and wear them down to gravel and sand. The tides and currents wash this gravel and sand along the shore, forming beaches and sand-bars. They do the same with the silt brought down by rivers or blown by wind from the land. In this way the sea-coast of every country is constantly changing—it is being built up in one place and worn away in another; here made shallow, there made deeper.

But many coasts have been formed and changed by earth-movements. Dip a flat sheet of iron slantingly into water and you will find the edge of the dry part is nearly straight. If, however, you do the same with a piece of corrugated iron, the edge of the dry part will not be straight. Little bays will run along the hollows while the raised parts of it will run out a little way. In the same way, if the land along a coast is perfectly flat, and an earth-movement lowers it so that the sea flows over part of it, its new coast will be nearly straight. If, however, it is not level but irregular, its new coast will not be straight, but winding. Now land is usually rugged owing

to denudation. Therefore, as a rule, coasts which have sunk beneath the sea are not smooth, but broken. The sea will fill up the former valleys, making bays and harbours. A ridge, if completely covered with water, will now be a shoal or bank. Hills partly submerged may be surrounded by water, forming islands separated from each other and from the mainland by straits. A very slight lowering of the peninsula of Kathiawar would turn it into an island.

If the level of the Indian Ocean were to rise only a few hundred feet, the Deccan of India would be an island and the Indo-Gangetic plain a shallow sea washing the base of the Himalayas. In 1819 a large part of the western border of the Rann of Cutch, some 2000 square miles in area, suddenly sank about 12 feet, and the whole tract was turned into a shallow lagoon. Ceylon was at one time part of India. A sinking of the land made it an island, separated from the mainland by a shallow strait. It is believed that many coasts have been formed like this. The coasts of Norway, of Chile, of Western Scotland, of the western side of the South Island of New Zealand, and of the Atlantic and Pacific borders of Canada are examples. A coast formed like this, fringed with islands, is called by its Norwegian name a **fiord coast.**

Some coasts, on the other hand, have been formed not by sinking but by uplift. The sea floor round the land has been raised to form a new coast. As a rule the sea-bottom round the mainland is regular and nearly flat, because the deposit of land waste on it tends to make it level. By the uplift of such a sea-bottom a new straight coast line is formed. The land rises gently out of the sea and shallow water lies off it. There are no hollows which can form creeks and bays in the new coast line.

We can understand it makes the greatest difference whether the coast line of a country has been formed by the sinking of irregular land full of hills and valleys or by the raising of a flat sea-bottom. In the former case, there is plenty of deep water for ships to come near the land, plenty of bays suitable for harbours, and islands behind which they can take shelter. In

the latter case, the water is shallow for a long distance from the shore and there are few places suitable for harbours. The Coromandel coast is of this kind. There is not a single natural harbour on it.

Islands.—These have been formed in various ways. They are often found in groups or chains. Many of them are the crests of mountains or the tops of ranges of mountains rising above the sea. The Andaman Islands are believed to be the tops of mountains which have sunk. Others, such as the Hawaiian group, are clearly the cones of volcanoes which have built themselves up from the bottom of the sea. In other parts of the world, as we have seen, the old shores of continents have sunk and the higher parts still remain above water as islands. The British Isles are the highest part of a great shelf, most of which now lies under the North Sea. Perhaps the fringe of islands off the Pacific coast of Asia has been formed in the same way. Again, a river which brings down a deal of silt often builds up flat islands at its mouth. The Ganges, the Amazon, and the Orinoco are examples. Coral islands, found in the warm oceans, are formed, as we shall learn, in quite a different way.

Capes.—On the coasts of islands and of the mainland we see the names of capes marked. They are usually rocky headlands which project into the sea. Many of them are very important to sailors, for they show where the line of the coast turns and where dangerous rocks and strong sea-currents are to be found. On most of them lighthouses have been built, each with a light or flash of its own, so that even at night sea-captains can tell where their ships are sailing. Cape Comorin is not important, for vessels seldom come near it.

Straits are narrow passages of water between islands or mainlands and joining seas or oceans. They also are important to sailors as waterways. Harbours, forts and lighthouses are often built on their coasts. Aden, Singapore, Gibraltar, and Dover are important because they command the passage of straits much used by ships. Day and night, during the Great War, war-vessels kept watch at Dover to prevent German

battleships and submarines from passing into the English Channel.

Isthmuses, which are narrow bridges of land joining large pieces of land such as continents, are, on the other hand, a hindrance to navigation, and ship canals are dug across some of them. The Suez Canal and the Panama Canal are examples. Some day, perhaps, a ship canal will be dug across the narrowest part of the Malay Peninsula to join the Bay of Bengal with the Gulf of Siam. It is there only about twenty miles broad.

Rivers.—We have already studied the work done by rivers, and learned how useful they are to man. They are the great drains of the land. They carry back to the sea much of the rain that has been evaporated from it and been blown in clouds on to the land. The volume of water carried by a river depends on the size of its basin and on the rainfall of that basin. In order to know whether a river is useful, we must ask several questions. In its mountain course, when it flows swiftly down its narrow valleys, can it be used to drive machines or to make electricity? Does it come from melting snows so that, even in the dry season, it has plenty of water? When it leaves the mountains, has it widened its valley and made it into a broad, open and nearly level plain; or, are its valley and those of its feeders still narrow and steep? Does it bring down plenty of mud and water to fertilise the lands on its banks so that they are covered with fields, and full of villages: or does it flow through marshes or deserts where crops cannot be grown? Is it deep enough for boats or steamers; or has it a swift and shallow current flowing over rocks and waterfalls, so that navigation is difficult and dangerous? Does it dry up, or nearly dry up, for some part of the year? And, when it reaches the sea, does it, like the Indus, form a delta with shallow distributaries and sandbanks at its mouths; or, has it, like the Thames and St. Lawrence, a deep estuary up which ocean vessels can come? Does it enter a sea which is a highway of trade, or an ocean like the Arctic, full of ice and seldom visited by ships?

OCEANS AND OCEAN FLOORS — OOZE — CORAL.— Oceans.—Nearly three-quarters of the earth's surface is covered by sea water. If the earth were a smooth globe with no heights or hollows on its surface, the ocean water would cover the whole of it to the depth of nearly two miles. Of the five oceans the Pacific is nearly twice the size of the Atlantic, and nearly two and a half times as large as the Indian. The Arctic and Antarctic Oceans are much smaller. The ocean floors have, like the surface of the dry lands, been formed by earth-movements, by volcanic action from below and by deposition. But, of these, earth-movements have been much the most important. The great ocean basins are parts of the earth's crust that have sunk. From the ocean beds many volcanic cones rise above sea-level, both along the borders of the continents and as islands far out to sea. Deposition goes on all over the sea floor but in the deeper ocean, far from land, it is very slow and there is but little of it. Here, too, in the depths of ocean far away from the restless shallow waters of the shore, the water is still. Therefore there can be no denudation. The ocean floor is the gathering place for the waste of the land. Rivers pour into the sea the silt they wash down from their valleys; on the coasts, waves and currents crumble down the rocks and sweep some of the sand out to sea; from the shore winds blow clouds of sand seawards. Even ashes flung from volcanoes fall on the surface and gradually sink to the bottom.

Most of the waste of the land washed or blown into the sea sinks on to the shallow platform or continental shelf, which stretches out under the sea from the mainland. A shelf like this extends out from the coasts of India. Only very little of this waste from the land ever reaches the great depths of ocean. But it is different with the minerals such as lime. These are dissolved in water and carried far out from the shore. There they are used by millions and millions of tiny creatures to build their shells or skeletons. When they die, their shells and skeletons remain and sink to the bottom. Thus a large part of the great ocean floors is covered with a kind of slimy **ooze**,

every bit of which is made up of tiny bits of these shells. This deposit is very slowly formed. How thick it is we cannot say. But millions of square miles of the ocean floor are covered with it. If we examine a piece of chalk with a microscope, we find it is made up of small pieces of shell. It was formed just like the ooze, but in shallow seas, long ages ago. Countless millions of tiny skeletons and shells there sank to the bottom. They were hardened into chalk, layer after layer, by the great pressure of the water above them. Then some earth-movement took place, lifting the floor of the sea and making it dry land. We dig into this dry land and find it made of chalk rock.

Besides the ooze-covered parts of ocean there are even larger areas covered with a kind of red clay deposit. This is the most extensive deposit on the earth, and covers an area of about fifty-five millions of square miles or nearly equal to that of the land, and it is found at the greatest depths below 12,000 feet. This clay is made up of the remains of tiny sea creatures, which have lived in the waters above, mixed with grains of ash vomited from volcanoes. This deposit is very slowly formed.

The work of turning the lime in sea-water into shells and skeletons is going on in the shallow waters of the sea as well as in the depths of ocean. On every beach we see scattered the empty and broken shells or skeletons of crabs, shell-fish and other fishes. Many of these, such as oysters, live in colonies and form banks of shells in shallow water.

Coral.—But the most wonderful deposits of this kind are formed by the tiny creatures called coral polyps, which use the mineral matter in sea-water to form shells or skeletons. When the polyps die, these skeletons remain as deposits and often these deposits form reefs stretching far along the shallow waters near the shore. Divers tell us that many parts of the sea-bottom are covered by beautiful jungles of coral built up by these creatures. But they can thrive only in certain suitable spots. They cannot live in water which is cold or more than about 100 feet deep. They are, therefore, mostly

found in the shallow parts of warm seas and oceans. They cannot, like fish, move about to seek their food, and so they can only thrive where sea-currents carry food to them. Nor can they live in water which is not pure sea-water, nor opposite the mouths of rivers where the muddy water would kill them. The polyps do not build the reef above water. But when they have built it up to the water-level, the waves may make it higher by piling up broken pieces of coral. Then plants may

FIG. 62.—A Coral Island.

begin to grow and by their growth and decay they help to form soil. In this way a coral island is gradually built up. The Maldive and Laccadive Islands, off the west coast of India, are made of coral. It has been built up out of the lime in the sea by these tiny creatures, on shallow banks which are parts of the sunken parts of a continent that once joined India with Africa. There are many coral-reefs in the shallow strait separating India from Ceylon. Off the Pacific coast of Australia there is a coral reef more than 1200 miles in length—longer than the west coast of India. By burning chalk, shells and coral we turn them into lime again.

CHAPTER XIX.

FOSSILS—WHAT THEY TEACH US.

IN the sedimentary or secondary rocks fossils are found. **Fossil** is the name given to the remains of any plant or animal found in rocks. It may be the leaf or seed of a tree, or its bark or

FIG. 63.—Fossil of a leaf in a piece of coal.

root, or the shell of a crab, the wing of an insect, the tooth of a shark, or only the mark left by any of these when the rocks were formed. These bits of plants and animals have been turned into rock. Thus if a fish died, and its body sank to the

bottom of the sea and slowly became covered with sand, and this sand was hardened into rock, every bit of the fish as it rotted away was replaced by particles of sand and was very slowly turned into sandstone. Hundreds of these stone fishes or fossil-fishes have been found in sandstone rocks. Whenever we find such fossils, they tell us something about the earth at the time when the rocks containing them were laid down as sediment on the floor of shallow seas millions of years ago. The still water there saved them from destruction. Any plant or animal dying on land quickly rots away; the particles of which they are made are carried off by wind and rain and disappear. Coal is one of the few fossil-bearing rocks formed on land because, in marshy places, the acids of the water have preserved the plants living in it. In coal-beds, therefore, we find clear prints of leaves and bamboos. Of the land animals only those with hard parts such as bones or teeth have been preserved as fossils.

Fossils tell us many wonderful things about the history of our earth. For example, in Siberia are dug up the bodies of huge creatures like the elephant, frozen in the ground. No such animals could live in cold Siberia now. Near the North Pole have been found fossils of animals which can only live in warm regions. No bamboos or palms grow in England to-day. Yet, bedded in the sandstone rocks of that country, are found the remains of such trees. Fossil corals, which could only have lived in warm seas, are also found in these rocks. Baluchistan is now a very dry country, but in it are found the fossils of huge crocodiles that once lived in deep rivers, marshes, and lakes. All these are proof that, in past ages, the climate of those parts of the world was very different from what it is to-day.*

Another wonderful thing taught us by fossils is this. The plants and animals of the earth have gradually changed.

* The explorers who in 1924 climbed nearly to the top of Everest found there fossils of creatures that lived in the sea. This tells us that, long ages ago, the floor of a great sea was lifted up to form the slopes of the Himalayas.

Those living in India or Europe or Africa to-day are quite unlike those which lived and died there long ages ago. In the oldest sedimentary rocks we find only low forms of life, such as corals and shell-fish. In the rocks above them are fossils of crabs. Only in the later sedimentary rocks do we find animals with a back-bone—first fishes, then reptiles, then birds, and then milk-giving animals. At first plants had no flowers nor fruit. Gradually, as the ages rolled on, the plants and animals became more and more like those we see living around us.

The rocks and soil are like a great book in which we can read the history of our earth. The beds of rocks are its pages; the fossils and other marks on the rocks are the letters. When we dig into the earth, we, as it were, turn over the pages. This book is not finished. Slowly new pages are being added to it. If we dig into the mud of a delta, we find branches of trees or leaves, washed down by river floods perhaps only last year or a few years ago. By digging into the east coast strip of India, in many places we come to beds of sea-shells very like those of the present shore. This tells us that, not very long ago, this part of the land was covered by the sea. We see rocks some distance inland from the coast, with marks made by sea waves. We know, therefore, these rocks were once on the edge of the old shore. Heaps of stones brought together by glaciers are found at some distance from the Himalayas. From this we know that at one time the snow and ice which now covers only the tops of the highest valleys of these mountains, in past ages extended far beyond them, and, therefore, that the climate of Northern India was at one time very cold.

From the sedimentary rocks we learn a great deal. By their formation we know they were deposited as sand, clay or lime at the bottom of ancient seas. Large parts of India are covered with rocks of this kind and they are so like the rocks found in Central Africa and Madagascar, that many geologists believe that all these rocks are part of a great ancient continent which once included India, Madagascar and Africa. A large part of it, however, sank down and now forms the floor of the Arabian Sea. If we see a limestone rock lying on one made of

sandstone, we may be sure some great change must have stopped the laying down of sand and begun the laying down of lime. If a bed of corals lies above a bed of coal, then, after the coal was formed, the land must have sunk beneath the sea.

The sedimentary rocks are full of fossils of many kinds. In the most recent or youngest of these rocks the plants and animals are not very unlike those of to-day, but as we dig into the lower beds of these rocks, we find marks of plants and animals quite unlike those now on the earth. Deeper still we come to older sedimentary rocks which have been greatly changed by heat, so that the remains of any plants and animals buried in them have been entirely destroyed. The limestones in these beds have been turned by the heat into marble. Then still deeper, we come to quite different rocks—the primary rocks—which do not lie in beds but in great masses. On them are no marks or fossils of plants or animals. In those far distant ages, therefore, none such existed. Perhaps there was then no water and no life on our globe at all. The marks on these primary rocks show us they have been twisted and bent and cracked by great movements of the earth's crust. We can see clearly some of them were once melted and flowed, or were squeezed and twisted when quite soft (*v.* p. 141). Thus sedimentary or water-formed rocks lie over primary rocks, not under them. If in any part of India we find solid primary rocks on the surface, we know at once it is no use sinking mines through them to find sandstone or limestone or coal. These can only be found above primary rocks for, as we have seen, they were formed by heat and cold, rain and running water out of the primary rocks. No mining engineer would ever think of trying to find coal or sandstone or petroleum below the hard primary rocks that make up the Nilgiri and Anaimalai Hills.

The science that teaches us the history of the rocks and soil of the earth on which we live is Geology—the sister of Geography. Books have been written by geologists in which we read how in India the primary and secondary rocks were formed and where they are found, how earth-movements and

the work of denudation and deposition have been going on for millions of years from the time when no living creature or plant was in the world. Other books have been written telling the history of rocks in other parts of the world. In these books we see maps not of the surface of the earth but of the rocks lying beneath it—here gneiss and granite, there marble and slate; here chalk, sandstone or clay; there deep beds of gravel, clay and silt. There we also see pictures showing how rocks have been formed by the cooling of melted stuff; how they have been laid down in the bottom of old seas and raised up to form dry land. In these books, too, we see drawings of fossils, now kept in Indian museums, which tell us about the curious animals and plants that lived and died millions of years ago, before there were human beings on the earth. Through long ages, before man appeared on the earth, the great forces we have studied were preparing the earth as his dwelling-place where he can grow plants, breed animals, and dig up minerals for his use.

CHAPTER XX.

THE GEOGRAPHY OF VEGETATION.*

PLANTS, in order to thrive, must have suitable soil and enough light, heat and moisture. Since soils differ greatly, and since heat, light and moisture are distributed unevenly over the world, plants growing in one part of the world are different from those growing in another. Some soils are firm, others are loose, some deep, some shallow. Clay and black cotton soil retain moisture for a long time : a sandy soil soon becomes dry. One soil contains much lime or salt or decayed vegetable matter ; another contains very little. The coconut palm can thrive on a salt sandy seashore. Some plants in order to bear leaves, flowers and fruit, need much more heat than others. The date-palm needs twice as much heat to ripen its fruit as maize. Cacao, pepper, sugar-cane and plantains can only thrive in very hot countries where there is plenty of moisture. Some plants are killed by frost ; others are not. Plants growing in the desert can live with only a very little rain or dew ; others live altogether in water. We do not look for lotuses in the Thar. In India we have "wet" crops such as rice, and "dry" crops such as maize and millet.

Plants suit themselves to the soil and climate in which they grow. If the warm ripening time is very short, their fruits ripen very quickly ; if plenty of rain falls, they do not need deep roots to store the moisture, but they have broad leaves to breathe it out quickly. Where very little rain falls, plants must store moisture. This they do by their deep roots and thick leathery leaves.

* In this book are maps of the vegetation of India and of the continents.

Regions of Vegetation.—We can, therefore, divide the world into regions of vegetation, according as they are hot or cool, damp or dry. But we must remember these regions are not sharply separated. They merge into one another. As we go over a country or a continent we find it becoming gradually less and less warm or cold, or gradually less and less dry or damp. We must also remember that man has made great changes in the vegetation of the world. He brings plants and seeds from one part of it and grows them in another. Tobacco is not a plant native to India, nor is maize nor coffee. He destroys jungle to clear the ground for fields of grain. By digging canals he can turn a district which is half-desert into a fertile area. If no one lived in India, most of it would be covered with grass and jungle, with forests on the banks of the rivers and on the rainy hills. But in India there are over thirty-two crores of people who must be fed by plants bearing grain and fruit, and, so, very large tracts of the grass and jungle land have been ploughed into fields. The same thing has happened in the thickly peopled parts of China and other countries. In the same way, Europe was once covered with forests, but these have been largely cut down to make room for crops.

1. **Equatorial and Monsoon Forests.**—In the tropics near the equator, where there is always plenty of heat and rain, we find dense forests of tall trees, interlaced with creepers. Every plant has to struggle upwards to reach the light, for underneath the dense foliage it is dark and here there is no grass, for grass cannot grow without sunlight. The trees here are called evergreens, for at all seasons of the year they bear leaves, flowers and fruit.

In such forests the palm is the typical tree, and of it there are very many varieties. Hard woods, bamboos, rubber-yielding trees, creepers and tree ferns are very common. Rain falls all the year round; the soil is made fertile by decayed leaves and branches, and overhead there is the blazing sun. Growth is therefore very rapid. Bamboos, especially, spring up very fast. The whole surface is closely covered with vegetation,

and there are no bare patches. Man can only make his way through these forests by cutting paths with an axe. Such equatorial forests are found on both sides of the equator in Africa, as the map shows. A broad strip of them covers the east coast from Mombasa to Natal and the coasts of Madagascar. But the main block of forest is in the Congo basin and along the Guinea coast. The oil palm, ebony, teak and mahogany are the most useful trees. In South America the equatorial evergreen forests of the Amazon and its feeders are even larger and denser than those of the Congo. This hot region, which is deluged with rain, is one vast, dense forest, but it is little fitted to be the home of man. Rubber is the chief product, but there are thousands of useful plants and trees. As yet, however, they have not been cut down owing to the cost of labour. The region is a land of plants, not the home of man. Equatorial forests are also found on the rainy islands of the East Indies, where palms and coconuts are the chief trees.

Even in those parts of the tropics where rain does not fall all the year round, but only very heavily during a part of it, we have **monsoon forests** of this kind. In India they extend along the slopes of the Western Ghats, the mountains and plains of Burma, and on the slopes of the Himalayas—just those places where the monsoon brings most rain. Similar forests are found in the Malay Peninsula, also on the northern coasts of Australia, fed by the rains of our cold weather monsoon.

2. **Tropical Grasslands or Savannahs.**—Bordering these equatorial and monsoon forests are regions which have a long dry season but plentiful rains in the wet season. Here dense forests are impossible, owing to the long period of drought. The trees are few and scattered, growing singly or in small groups, especially in moist valleys. But the heavy rains favour grass which grows up and bears seeds very quickly during the wet season. It covers the whole country, growing often to the height of six feet. In the dry season this grass dies down and the country then looks bare. But the grass seeds, having ripened quickly, take root when the next wet

season comes. If there were no cultivation, most of the Indian peninsula (except the wet west coast), and the Indo-Gangetic plain (except the Thar desert and the dry parts of Sind and the Punjab), would be a tropical savannah land. In Africa these savannah lands stretch right across the continent in a broad belt, both north and south of the equatorial forests of the Congo, and in South America north and south of the equatorial forests of the Amazon. Here they are called llanos. In Australia they form a belt bordering the monsoon forests in the north.

3. **Tropical Deserts.**—In regions where the dry season is longer and less rain falls, the savannah lands gradually pass into semi-desert or scrub lands, and these into true desert, where hardly any rain falls at all. In India the region west of the Aravallis is semi-desert, with true desert—the Thar—near its centre. In the Punjab, man, by the help of magnificent irrigation works which use the water coming from the Himalayas, has turned parts of semi-desert into fertile cultivated fields. In Africa the northern edge of the Savannah lands merges first into semi-desert where the dry season is long and but little rain falls, and then, farther north, into the true desert of the Great Sahara. This desert is very much larger than the whole of India, and stretches from the Red Sea coast in the east to the Atlantic in the west. In the north it merges into a narrow strip of semi-desert along the southern shores of the Mediterranean Sea. The south-western edge of the southern savannah belt of Africa merges into semi-desert and then into the true desert of Kalahari. The semi-desert and the Sahara of northern Africa are continued across the Red Sea, the Persian Gulf, and the Caspian Sea nearly to the coast of the Yellow Sea.

This dry area includes Arabia, Persia, Baluchistan, Afghanistan, part of Asia Minor, Turkestan, Tibet and Mongolia, over which moisture-bearing winds seldom blow and much of which is far from the sea. The largest Asian deserts are those of Arabia and Gobi in Mongolia. In all this vast region very little cultivation can be carried on, except in places where wells

can be dug to reach underground water, or where the melting of the snow on the mountains forms rivers. It is a land chiefly of herdsmen, wandering with their flocks in search of scanty pasture.

A large part of the centre of Australia, far from the sea, is desert or semi-desert, and in North and South America the map shows patches of semi-desert or of true desert. Here the winds from the Pacific cannot bring rain, as they are stopped by mountains.

The cause of deserts is simply the want of water. In many deserts no plants at all can live, especially where, as in the Thar, the wind heaps up the sand like huge waves. As a rule, however, a few plants are found here and there. They are all suited to the dry climate, being able to store water in their leaves and roots, and having leathery and sharp-pointed leaves which prevents them from breathing out moisture quickly. Thus, the cactus has thick stems and deep roots containing stores of water, and its leaves are spines. Occasionally a rainstorm may take place, and then the desert plants blossom and bear fruit very rapidly. Even in tropical deserts the sand cools very rapidly at night, and a little dew is formed sufficient to keep the plants alive. Around the borders of these deserts, where underground water comes close to the surface, or where a river flows across it, the plants are more plentiful and a few dwarf bushes and patches of grassland are found. The Nile makes a green strip of cultivation across the eastern edge of the Sahara. So do the rivers flowing into the Caspian Sea and the twin rivers that enter the Persian Gulf.

4. **Grasslands of Temperate Climates.**—In temperate regions, not far from the tropics, where there is a long dry season and only moderate rain falls, we find wide stretches of grassland. In Asia they stretch north of the desert and semi-desert lands, east of the Caspian and are called steppes. In North America grasslands form a broad belt in the middle of the continent and are called prairies. In South America they stretch across the basin of the Paraguay river as far as the Tropic of Capricorn and are called pampas. In Australia they lie on both sides

of the Murray river on the dry, or inland, side of the ranges facing the Pacific. These are the great sheep-rearing pasture lands of Australia. These grasslands in Asia, South America and Australia are still chiefly used as pastures. In America large parts of the wetter parts of the prairies have been turned into plough-lands growing wheat and maize. Grasslands formerly covered almost the whole of Europe that was not forest, but now they are almost all cultivated.

5. **Forests of Temperate Climates.**—In the temperate regions are different kinds of forests. In the North Temperate Zone, **cone-bearing forests** stretch in a broad belt right across the north of North America, Europe and Asia. Here the winters are very cold, the summers short and the rainfall rather scanty. Most of the trees keep their leaves as a protection in winter, and these leaves are small and needle-like, so that they do not transpire much moisture. Their fruits are hard cones. Firs, pines, and larches are cone-bearing trees. On the colder northern edge of this great belt of forest, the trees are few and dwarfed; to the south they are larger and supply excellent soft timber (much more easy to cut than teak), called deal. Matches, imported to India from Europe, are made of this wood. It is also largely used for boxes and is ground into pulp, from which paper is manufactured. The sap yields turpentine, pitch and resin. Such trees also grow naturally on the higher and colder slopes of the Himalayas, and they have now been planted and grow well on the highest of the Nilgiri Hills.

Another kind of Temperate Forest is found farther south, where the climate is warmer. Here the trees are oaks, beeches and maples—trees which shed their leaves and rest during the cold months. Such forests are found in Central Europe (but not on the dry Mediterranean coasts), in the eastern half of North America and in Japan, as well as in New Zealand, on the south-east coast of Australia and the coasts of Southern Chile in South America.

6. **The Mediterranean Vegetation.**—On the shores of this sea, rain, as we learned, falls chiefly in winter when it is too cold for plants to grow much, and the summers are hot and dry.

Little rain falls in the growing season and, so, the trees are short with tough leaves and deep roots. There are more bushes than trees. The olive is a typical tree of these regions. The hot dry summers ripen fruits well.

7. **Tundras and Ice Deserts.**—In the polar regions along the coasts of the Arctic Ocean in North America, Asia and Europe, where even the summers are cool and the winters very cold, and where snow falls more than rain, the ground is frozen hard for several feet below the surface all the year round. Even in the short summer it only thaws to a depth of a foot or two. Here, therefore, no plant with a deep root can live. Only a few dwarf bushes are to be seen. In the short summer when the snow has melted, the ground is covered with moss on which the reindeer feed. In the south the tundra merges into the coniferous forest. On the Antarctic continent round the South Pole there are no land plants at all. It is a desert of ice. So is Greenland, except on its southern coasts.

8. **Mountains.**—When we climb mountains we see how plants change with climate. If we climb even to the top of Dodabetta, the plants there are all strange to us. If we go up very high mountains in the tropics, near the equator, the changes are greater. We first pass through dense equatorial forests. These cover the base of the mountains and are full of thick jungle with palms, bamboos, tamarinds and pipals. Higher up we come to forests like those of warm temperate climes, where oaks and other broad-leaved trees abound. Above them we reach the belt of coniferous forest. Gradually, as the air becomes colder, the trees are more stunted, and shrubs and bushes take their place. Above the level of shrubs we reach a semi-desert like the tundra, with only a few plants which can live though covered with snow for months in the cold season. Beyond that stretch fields of ice and snow where no plant can live. Thus, in climbing to the top of the Himalayas we find, one after another, the same kind of plants as we do when we travel from the tropics to the poles.

9. **Oceans.**—Sea weeds grow in shallow coastal seas and float on the surfaces of oceans.

CHAPTER XXI.

THE GEOGRAPHY OF ANIMAL LIFE.

Distribution of Animal Life on the Earth.—All animals need food and water: where these are plentiful, as in forests, we find many animals, but in deserts and very cold countries there are few. Unlike plants, animals can move freely about, and they can adapt themselves to climate and so they are prevented from spreading from one part of the world to another, not so much by heat and cold as by barriers such as the ocean, deserts and high mountains. But these do not stop birds. Many birds, such as ducks and snipe, visit India every cold season, flying in flocks from Siberia and other distant countries. Man has, however, greatly lessened the number of wild animals. He has burned down jungles which were their haunts and turned them into fields; he has tamed the useful animals and hunted down those which are his enemies or the destroyers of his flocks and fields. There are many fewer tigers, leopards and wild elephants in India than there used to be. The Indian lion is almost extinct. All animal life depends directly or indirectly on plants. Where there are plenty of plants there are plenty of animals that feed on plants, and where there are plenty of plant-eating animals we are sure to find plenty of flesh-eating animals that prey on them. In India there are dense forests and marshes which are the haunts of many kinds of animals; there are also deserts and half-deserts where few animals can find food.

Animal Life in the Forests.—In the hot, damp, dense forests near the equator the undergrowth is so thick that there are few animals that cannot fly or climb, except the elephant.

which can force its way through it. Among the leaves and flowers there are numberless birds and insects. These forests are also the home of many kinds of monkeys, tree-frogs, tree-snakes and lizards. In the more open forests, where less rain falls, such as those of India, we find more ground-living animals. In India there are tigers, leopards and bears. In the temperate regions there are wild pigs, wolves, wild cats, foxes and squirrels. In the cone-bearing forests of the north, both in Eurasia and America, where the winter is very cold, most of the fur-bearing animals are found.

In Grasslands.—Here we find grazing animals such as deer and antelope of different kinds, wild horses, zebras and cattle. They are hunted by their enemies such as lions, tigers, hyenas and jackals. On the uncultivated grass-lands of India there are many kinds of deer and antelope. On the grassy slopes of hills and mountains we find wild buffaloes, bison, goats and sambar. The wild yak has its home on the Himalayas. The grazing animals, as they have no defence against their enemies and also because they have to travel great distances in search of pasture and water, are usually very swift-footed. In these regions flightless birds, such as the ostrich and emu, roam about.

In Deserts.—Here, as there are few plants and little water, there are few animals. Insects live on the plants and are the food of lizards and of a few birds. The camel is the "ship of the desert." In the streets of Bikaner, Multan, Peshawur, and Karachi we see lines of camels. How many do you think you would see in Dacca, Mangalore, Madras, Rangoon or Colombo ?

In the Cold Tundras.—During the long winter months when the ground is covered with snow and every drop of fresh water is frozen, the land animals wander south to warmer places—except the white, thick-coated polar bear, which lives by hunting fish and seals in the sea. In the short summer when the ground thaws, it is covered with moss and the wild reindeer in Asia, and the elk in America, move north to feed on it. The pools and marshes are then the breeding

places of countless insects, and flocks of birds fly northward to feed on them and to nest.

On Sea-shores and in the Sea.—In all parts of the world the sea-shores are the home of great flocks of sea-birds, which dive or wade or swim catching their food in the water, or hunting for shell-fish and crabs on the beach. The sea-shores, where the water is shallow, are full of plant-life, and therefore give food to a large number of fish and sea creatures. The best fishing places in the world are in the shallow sea. Men do not fish in the deep oceans. Round the shallow coasts of India, as well as in rivers and estuaries, very many kinds of fish are caught for food. There are far more creatures living in the sea than on the land ; they feed on tiny plants and the large ones devour the small ones. The largest sea-animals are whales, walruses and seals, but in every bucketful of water taken from the ocean surface there is a whole world of millions of tiny creatures too small for the eye to see. In the depths of ocean there is no light and no plant can live. The fish living there must either feed on the dead animals and plants that sink down to them or on one another.

CHAPTER XXII.

THE PRODUCTS OF THE EARTH AND THEIR USES.

Food Grains.—The chief use that man makes of the earth is to grow plants for food. At first he lived by gathering wild fruits of the forest, digging for roots and hunting wild animals. But thousands of years ago he taught himself to grow and cultivate certain grasses which we call cereals, such as wheat, rice and millets. Some of these grow best in temperate climates, others in hot climates ; some like damp soil ; others can grow with little rain. The chief crops of temperate climates are wheat, rye, barley and oats.

Wheat has been cultivated for thousands of years. It is the most nourishing of all grains and it is grown more widely throughout the world than any other food crop. All it asks is a loamy soil into which it can send its deep roots in search of moisture, a little rain to give it a good start, and plenty of sun to ripen it. Frost does not kill it and in temperate climates it lies in the frozen or snow-covered ground for weeks. But damp air spoils it. In India it is widely cultivated and the United Provinces and the Punjab produce about three-quarters of our total crop. Very little is grown south of the Godavari, and the damp air of Bengal does not suit it. On the irrigated lands of the Punjab, where the air is dry and the ripening, moderate heat of February and March is like the heat of July and August in temperate climates, it grows splendidly. In Europe wheat is only grown in the drier parts, and its grain, ground into flour and baked into bread, is the ' staff of life ' of the people. It is the chief grain crop of the drier parts of the British Isles. The prairies of Canada and the United

States, which have cold winters and dry summers, produce large harvests. Australia and New Zealand also grow large crops. Ship-loads are sent to Britain, down the Great Lakes and the St. Lawrence river of Canada, from the northern shores of the Black Sea, from the seaports of Australia and from Karachi.

Barley is another cultivated grass very like wheat, but it is used less for human food and more for feeding cattle and making malt, from which beer is brewed. It is grown in the same countries as wheat, especially in Britain, Canada, the United States and Russia. In Northern India it is a cold season crop like wheat.

Rye, another plant not unlike barley, needs much less heat than wheat and can be grown on poorer soil. Its home is therefore in northern Europe, especially in Russia and on the borders of the Baltic Sea. From it is made a kind of 'black bread' (a cheaper food than wheaten bread), which is largely eaten in Central and Eastern Europe. Rye is eaten in the countries where it grows and little of it is exported from them.

Oats like the same climate and soil as rye, but they are much more widely grown, both as cattle fodder and as a cheap food (oatmeal) for man. In Britain oats are cultivated where it is too cold or wet for wheat. The United States, Russia and New Zealand all export oats.

Maize is another cultivated grass. It was brought into Europe from America by Columbus. It is often called 'Indian corn' because it was grown by the people of America who, Columbus thought, were Indians. Maize likes a warmer climate than wheat, barley or oats, and does not grow well farther than about 50 degrees from the equator. The climate of Great Britain is too cold to ripen it. A little is grown, both as food and fodder, in India, but its home is the United States in the plains south of the wheat belt. Here three-quarters of the world's maize crop is produced. The fertile plains of Argentina in South America also bear rich crops.

Rice in hot countries takes the place of wheat. It is the chief food of half the people in the world, and is widely grown

in the monsoon lands of India, Burma, Siam, China and Java. Everyone knows the plant needs plenty of heat and moisture, and can be best grown where heavy rain falls and where the flat fields of plains and deltas can be flooded from rivers and tanks. In the monsoon lands, therefore, it is grown on the banks and deltas of rivers. Two harvests a year are sometimes reaped. Rice gives a very large yield per acre, and that is one reason why the monsoon lands are so thickly populated. Though it is easily digested, it is less nourishing than any other grain.

Bengal, with its huge deltas, produces half the paddy crop of India, but it is also largely grown on the deltas of the east coast, and on that of the Irrawaddy as well as on the rainy west coast strip, and under thousands of wells and tanks in other parts. India, with her large population, needs almost all the rice she grows for her own food, but ship-loads are exported from Rangoon, both to India and other rice-eating countries. Some is also sent to Europe, partly for food and partly to make starch.

Millets.—These are also tropical plants. In India, they are 'dry' crops and are therefore grown where there is not enough water for paddy. There are many kinds. Jowar, bajra and ragi are the chief. Along with dal and gram they form the chief food of the poorer people in India. The straw is used for fodder. Millets are not exported.

Along with cereal crops the people of India grow different kinds of pulses, *i.e.* pod fruits, such as gram, which make up a large part of their daily food. In temperate climates **potatoes** take the place of pulses. The plant was introduced into England from America more than 300 years ago and its cultivation has spread over Europe and all temperate climates. The climate of the plains of India is too hot and damp to suit it, but good crops are grown in cool valleys among the hills, and the potato is now a common food in India.

These are the chief food crops of the world and every country grows one or more of them. Man has also learned to cultivate plants which yield a refreshing drink or relish.

Tea, Coffee, Cocoa.—Tea is the dried leaf of a shrub, the home of which is in China and Assam. Less than 100 years ago it was not cultivated in India but now Assam, Darjeeling, the Punjab hills, the Nilgiri Hills and Ceylon supply most of the tea drunk in the world. The shrub grows best on easily drained slopes with plenty of heat and moisture. The best crops are got where there are frequent showers to bring out the tender leaf-buds from which the finest tea is made. Assam, which receives rain nearly all the year round, has therefore the best climate for tea and produces about three-fourths of all the tea grown in India. The hills of Ceylon which receive the rain of both monsoons are also well suited for the cultivation of the shrub. Almost all English-speaking people in the British Empire drink tea once a day at least, and India and Ceylon supply it. Fifty years ago they drank China tea. The people of India do not drink much tea but its use is increasing. The people of China and Japan grow and drink tea. As each leaf has to be plucked separately by hand, tea can only be profitably grown where wages are not high.

Coffee is the dried berry of a shrub which can only thrive in, or close to, the tropics. Its first home was probably Abyssinia and from there it was introduced into Arabia. It is said to have been brought into India more than 200 years ago by a pilgrim returning from Mecca. The shrub thrives best on hills about 3000 feet above sea-level and in a damp, warm climate. In India it is grown in the south of the Deccan, chiefly on the Mysore and Nilgiri Hills. This country produces only a small part of the world's crop, but it is perhaps the finest in the market. Mangalore is the chief port of export. Very little coffee is drunk in India and much has, therefore, to be sent abroad. The warm, moist high-lands of Brazil are very well suited to the growth of the shrub and this country produces more than half the world's crop. The warm damp hills of the West Indies are another important source of supply. The people of Europe and the United States are large coffee drinkers and have to import it all from warmer countries.

Cocoa.—The cacao tree, unlike the tea and coffee shrub, is

very delicate, for it will not flourish beyond 15 degrees north or south of the equator and not higher than 600 feet above sea-level. It is thus only grown in a narrow belt. The deep, moist valleys of Central America and the northern Andes are the places most suited to it. It is also grown in the West Indies, in British West Africa and in Java. The climate of Southern India does not suit it, but some is grown in Ceylon away from the sea. Cocoa, or cacao, is obtained by drying and grinding the beans contained in long pods which grow along the trunk and branches of the tree. The powder is mixed with water and makes a refreshing drink. It is also made into a sweetmeat called chocolate.

Spices.—Most spices grow in tropical countries, and in former days there was a great trade in spices carried from the East to Europe by the Italians of Venice, and later by the Portuguese and the Dutch. **Pepper**, the dried fruit of a creeper, is the commonest of all. It is largely cultivated in Java, Siam and the Malay Peninsula and Ceylon, but the best pepper comes from the hot, damp gardens of Malabar. **Cinnamon**, the dried bark of a tree, grows well in the moist low-lands of Ceylon. **Ginger**, the underground stem of a plant, is another tropical plant needing a hot climate, rich soil, and a good supply of moisture. Large quantities are grown in India and Jamaica. The **nutmeg** tree also needs heat and moisture. The spice is made from the kernel of a nut which is covered by a tough and juicy rind, not unlike a lime. The tree grows wild in some of the Spice Islands and its cultivation has spread to most of the islands of the East Indies. Grenada, in the West Indies, has large plantations and there are a few in Southern India and Ceylon. **Cloves** are another tropical fruit growing in the East Indies, but the chief sources of supply are two islands, Zanzibar and Pemba, off the east coast of Africa. In India spices are largely used in curries. **Turmeric** and **chillies** are grown almost everywhere. **Cardamoms** come from the slopes of the Ghats in Travancore State.

Sugar is partly a relish and partly a food. It is found in nearly every plant, but in tropical countries it is obtained

chiefly from the juice of the sugar-cane. This cane has been cultivated in India for hundreds of years, and its first home is believed to have been in the damp and fertile soil of Bengal. It grows best in places which suit rice but, unlike paddy, it rots if water is allowed to stagnate at its roots. From India its cultivation spread westwards, and a thousand years ago the Arabs introduced it into the warmest lands round the Mediterranean. When the Spaniards conquered the West Indies, they planted it there and it flourished exceedingly. Negro slaves were taken over from Africa to work in the plantations. Sugar-cane is a tropical plant, but thrives best where there is salt in the air or soil. It is, therefore, largely grown on islands, *e.g.* Cuba, Java, Fiji and Mauritius and on the coast of Guiana in South America. In India, Bengal, the United Provinces and the Punjab are the chief sources of supply, but the canes do not give so much juice as those of some other tropical countries. Although India grows more sugar-cane than any other country, the crop is not enough for her needs and much has to be imported from Java and Mauritius. Gur is made from cane and palmyra juice. In sugar-growing districts factories make white sugar.

Beet Sugar.—Much of the world's sugar is nowadays obtained from **beet,** a root like a large radish, which grows in European countries such as France, Germany and Austria.

Wine is made from the juice of grapes. The best vines are cultivated in countries bordering the Mediterranean Sea, where the long, dry summers ripen the fruit perfectly. The plant has long been grown in South Australia and South Africa, which have a similar climate, and there a good deal of wine is made and exported.

Beer is brewed from barley and hops, the flower of a creeper. It is chiefly made and drunk in Europe where the climate suits the growth of these plants. In India there are several breweries in the cool hills.

Opium is the dried juice of the white poppy-plant. Cuts are made in the unripe seed-vessels, and from them flows a milky juice which hardens into a kind of brown gum with a

drowsy smell and a bitter taste. Opium is a very powerful and useful drug, as it eases pain, but it is poisonous unless taken in small quantities. In India the opium grown in the United Provinces is cultivated under licence from Government and is called Bengal opium. Malwa opium is produced in the States of Central India and Rajputana. Since 1913, when the Government of India agreed to stop exporting the drug to China, the cultivation of the plant has been greatly restricted. Before the war large quantities were grown in Asia Minor and Turkey, but now India is the chief source of supply to other countries.

Tobacco, the dried leaf of a plant, is a native of America, from which it was introduced into Europe and India more than 300 years ago. The warm parts of the United States produce more than half the tobacco grown in the world. The quality and flavour of the leaf depend on soil, climate and preparation. The best cigars are made from tobacco grown in the island of Cuba and in the Philippines. In India most people smoke cigars made from leaf grown in certain districts in Madras, Bombay, Bihar and Orissa, and Bengal. In Burma, where men, women and children smoke, large crops are also grown. Indian tobacco is not suitable for cigarettes or pipes. Turkey, Egypt and the United States send a good deal of this kind of tobacco to India.

Vegetable Oils.—A large number of plants contain useful oil. **Coco-nuts** grow best along the sandy shores of tropical countries. At the present day they are also grown in plantations. Everyone knows how useful every part of this tree is. From the white dried flesh of the nut (called copra) the oil is squeezed by machines and then purified. What is left of the copra can be ground down as food for cattle. In India the oil and the nut are used for food, and now in Malabar soap is manufactured from the oil. The nuts are also exported in large quantities to Europe, where the oil is used to make margarine (a cheap kind of butter), soap and candles. As this palm likes a smell of the sea, it grows best on tropical islands and coasts such as the East and West Indies, Ceylon, the Laccadive Islands,

Mauritius, Fiji and other islands in the Pacific. Another useful oil-giving palm is the **oil-palm** which grows wild in the damp, hot forests of West Africa. Its fruit is quite different from the coco-nut. Oil is got both from the flesh and hard part of the nut, and is used in the making of soap, candles, margarine and grease for the axles of railway wagons. This palm needs even greater heat and rainfall than the coco-palm.

Among tropical countries India grows most of the useful **oil-seeds,** such as linseed, rape, cotton-seed, sesamum, castor-seed and ground-nuts, and large quantities are exported.

Castor oil is largely used as a medicine, in lamps, and in machinery. It is especially useful in aeroplanes, as it does not so easily freeze at great heights, as do other oils. **Ground-nut oil** is largely used as a food and in the manufacture of soap. The best food oil is got from the fruit of the **olive tree**, which grows in the dry, warm countries round the Mediterranean Sea. A small bottle of this oil is sold for more than two rupees.

Rubber is the juice, not of the fruit or nut, but of the trunk of many different kinds of trees which grow in hot, damp, tropical climates. For long the forests of the Congo and Amazon, which both lie on the equator, were the chief sources of supply. But at the present day the tree is cultivated in plantations within 15 degrees of the equator, especially on the damp, hot lands of the Malay Peninsula, the Malabar coast, Burma, Java, Sumatra, and Ceylon, where there is no cold season and rain falls evenly throughout the year. The juice is obtained from cuts made into, but not through, the bark and collected in little tin cups, and then taken to the factory where it is allowed to curdle. It is then dried and pressed between rollers. By mixing sulphur with the rubber, it is made quite hard and is used in numberless ways—for tyres, pipes, shoes, electrical machines and flooring.

CHAPTER XXIII.

THE PRODUCTS OF THE EARTH AND THEIR USES (Continued).

Fibres.—Besides cultivating plants to give him food and drink, man has learned to use certain fibres which he can spin and weave into cloth and other useful materials. The chief of these is **cotton**. Every person in a civilized country buys at least one piece of cloth every year, and the market for cotton is, therefore, world-wide. Cotton is the lint, or white twisted hairs, surrounding the seeds contained in the boll, or fruit, of the cotton plant. This plant grows best on rich, well-drained soil. When young, it needs plenty of moisture, very damp air and frequent showers, but its seeds ripen best in dry sunny weather. It grows both in tropical and temperate climates, but chiefly in the latter. At present the chief source of the world's supply is the southern or warmer parts of the United States. The climate of India suits it, and it grows well in the regur or black soil of the Deccan. Gujarat, the Deccan districts of Bombay, the Central Provinces, the United Provinces, some parts of the Punjab, the southern districts of Madras, as well as irrigated lands in Sind and Hyderabad, produce large quantities.

Linen is made from the fibre of the **flax** plant, which grows equally well in temperate and hot climates. Its early home was Egypt, but its cultivation has spread to France and other European countries. The north of Ireland grows a great deal of flax which is spun and woven in Belfast. Russia, before the war, was the chief source of supply. In India the plant is grown for its fruit (linseed) not for its fibre.

Hemp, used in making ropes, twine and sail-cloth, is the strong fibre of a plant which, like flax, grows well both in tropical and temperate climates. Russia, before the war, was the chief hemp-growing country. This hemp is different from the hemp grown in Bengal. Another and finer kind of hemp is got from a plant like a plantain, which grows in the Philippine Islands. India grows other fibres which are used in the same way, *e.g.* sunn or Bombay hemp, ramie, and sisal hemp obtained from a plant like an aloe.

Jute.—The native soil of this plant is in Bengal where it grows to a height of ten feet. It needs great heat and plenty of moisture and, as it takes a great deal of nourishment from the soil, it can best be cultivated where the soil is constantly renewed by floods. Hence it is chiefly grown in the damp lower valleys of the Ganges and Brahmaputra. In fact, we may say that Bengal supplies jute to the whole world.

Silk is not a vegetable but an animal product, being spun by a grub called the silk-worm. More than 4000 years ago the Chinese bred worms for silk, but not till the sixth century were they introduced into Europe. Here, in the warmer parts of France and in Italy, a large silk industry sprang up. The best silk is got from silk-worms fed on mulberry trees, and it is only where these trees grow well that silk-worms are kept. In India mulberry silk is produced in the Punjab and Kashmir. In India there are also 'wild' silk-worms, which feed on the leaves of many other trees. In Assam a silk-worm lives on the wild castor-oil plant, called *eri*, and this name has been given to the wild silk of Assam. The tasar silk-worm, in India, also produces a silk much used in this country. China, Japan, Italy and India are the chief sources of supply of mulberry silk. The United States buy most of it.

Wool, another animal fibre, is obtained chiefly from sheep, but also, to some extent, from goats, the alpaca of the Peruvian mountains, and even camels. Wool is the sheep's protection against cold and, so, these animals are chiefly found in the temperate climates of Europe, Asia, the United States, South Africa, South America, and Australia. In certain countries

sheep have been bred to produce wool (merino), which is much finer and longer in staple than ordinary wool. The chief sources of supply of this fine wool are Australia (especially New South Wales) and New Zealand, South Africa, the Argentine, the United States and Great Britain. The wool of the Indian sheep (which is bred for mutton rather than for wool) is much inferior to that of Europe and Australia, and is rather like hair. The best Indian wool comes from sheep pastured in the Punjab, and in the hill districts of the United Provinces. But, as India is a hot country, wool is not so much used for making cloth, as it is in colder climates. The soft woolly hair of the Tibetan goat is woven into beautiful shawls in Kashmir.

The Manufacture of Textiles.—These fibres are spun and woven by hand and in hand-machines in the countries where they grow. To manufacture them on a large scale, spinning and weaving machines are needed, driven by steam engines. Hence, these manufactures are carried on in those countries which have large mines of coal and iron or which can easily procure them. Thus, though the cotton plant cannot grow in England, yet the spinning and weaving of cotton is the greatest manufacturing industry of Great Britain. The raw cotton is imported from the United States, Egypt, India and other countries. Manchester, surrounded by coal-fields, is the centre of a large number of towns full of factories engaged in this work. Some of these towns spin the raw cotton into yarn, others weave the yarn into cloth, others make the machines.

In India there are now many factories which weave quantities of the coarser kinds of machine-made cloth. Bombay is the chief centre of this industry. Behind it, across the Ghats, lie the best cotton-growing districts in India and railways join it to several others. Electrical power, to drive the mills, is made by turbines on the Ghats, and it has a fine safe harbour from which vessels can carry the cloth to all ports on the Indian Ocean and beyond.

The spinning and weaving of wool are also largely carried

on in England in towns round Leeds, which lies in the middle of coal-fields. Millions of sheep are bred in Great Britain, but they are not enough to supply all the wool wanted and large quantities are imported from Australia, New Zealand, and South Africa. Woollen cloth is largely exported. In the same way, flax is manufactured into linen in other towns in Great Britain, where coal can easily be got. Belfast, in the north of Ireland, is the chief centre of manufacture and export. Silk is woven by machinery in England, France, Italy and Japan.

Jute is made into coarse cloth and gunny bags in the Calcutta mills, to which it can be cheaply brought by river and rail, and the fuel is supplied by the Raniganj coal-fields of Bengal. These bags are sent to all parts of the world to hold goods of every kind. During the war Calcutta mills worked day and night making millions of bags to be sent to France where they were filled with earth and used to protect the trenches. Calcutta also ships large quantities of raw jute to Dundee, in Scotland, where it is woven, on a large scale, into cloth and carpets. Belfast is the chief linen-making town in Britain.

Timber.—The wood obtained from trees is one of the most useful substances. Different kinds of timber grow wild in the great forest regions of the world, but it is only in those countries where the logs can be easily brought by river, road or rail, to villages and towns that this timber can be fully used. The chief timber trees of India are teak, deodar, sal, sissu, ebony, rosewood, sandal and ironwood, but distance from markets makes many of the finest Indian forests useless for trade purposes, and it is found cheaper to import timber from foreign countries. Burma, however, exports a great deal of teak, because it can be cheaply floated on the Irrawaddy down to Rangoon sawmills, from which it is easily shipped on steamers. The chief timber-supplying forests are the cone-bearers, which stretch in a broad belt across the north of the American, European and Asian continents. Thus Canada and the United States, Newfoundland, Sweden and Russia,

are the main sources of supply. At the present day a great deal of timber is used to make wood pulp, from which paper is manufactured. It is thought that Indian bamboos will be largely used for this purpose.

Mineral Products.—Besides cultivating and breeding the plants and animals that live on the earth, man has gradually learned to use useful substances, called minerals, which he digs up from under its surface.

Coal, as we have learned, is formed of the remains of old forests of trees, like the palm and bamboo, and of mosses which grew up and decayed for long ages, and were then submerged beneath the sea where, for further ages, they were covered by mud and sand brought down by rivers. The weight of these layers of sand, mud, and lime, and of the water above, crushed and squeezed them into a hard, shiny, black mass, which we call coal. These beds of coal are found all over the world in sedimentary rocks, but only in certain places have mines been sunk to bring the coal to the surface. The largest coal-fields in the world are in Great Britain, Europe, the United States, Australia, South Africa and New Zealand. In India the chief coal-mines are at Raniganj in Bengal and in Bihar and Orissa. Coal is used to make steam to drive engines which work machines. It is also needed to smelt metals, for these are usually found in an impure state, called ore, mixed with other minerals and rocks. Where coal is found close to mines of iron, copper or lead, these metals can be cheaply smelted, but where this is not the case, it is found cheaper to bring the ores to the coal than coal to the ores. Thus, in countries which have large coal-mines, furnaces are built in which the metals, whether found close at hand or brought from other countries, are smelted.

Iron ore is found in almost every part of the world, but the most important mines are in the United States, Great Britain, Germany and other European countries. When smelted, it is made into cast iron, wrought iron and steel. Close to these coal-fields, towns grow up, which make iron and steel into all kinds of tools, machines and a thousand other useful

things. The chief iron mines in India are in Bengal and Bihar and Orissa.

Copper.—This metal is seldom found pure. Being a good conductor of electricity, it is largely used for telegraph and telephone wires, and for all kinds of electrical apparatus. Mixed with zinc it forms brass ; mixed with tin, bronze. The chief sources of supply are the United States, Chile, Canada, South Africa, Japan, Mexico and Spain In Great Britain but little copper is now mined. In India it is found in a few places, but little is mined and enormous quantities are imported.

Lead.—This heavy, soft and easily melted metal does not rust like iron and, so, it is largely used for pipes and roofs. It is very little mined in India, but the silver mines at Bawdwin, in the North Shan States of Burma, now yield a large supply. Spain, the United States, Mexico, Australia, Canada and Great Britain possess the largest mines.

Tin is a rare metal, found in a few places in South America, the United States, Europe and Australia, and not at all in India. The chief source of supply is the Malay Peninsula, which produces more than half the tin found in the world. The heavy monsoon rains falling on the mountains of this peninsula have washed and rubbed down the tin-bearing rocks, and formed vast deposits of tin, from which the metal is mined. As tin does not easily rust, it is used as a covering for iron. At Swansea, in Wales, this tin-plate industry is carried on on a large scale. Sheets of iron are dipped in molten tin and this tinned sheeting is sent all over the world, in the shape of boxes, canisters or tins.

Zinc, which is harder than lead or tin, was not known as a useful metal till about one hundred years ago. It is also used as a coating for iron and this galvanized iron is exported from England to India, to make roofs and other things. We see it in almost every village. Zinc is often found along with lead. Australia, Canada, Italy, Spain and Germany supply most of the world's needs.

India's Minerals.—As we shall see, India has few metals or mines. The most important of her minerals are coal, gold,

iron, manganese, mica. Burma yields large quantities of petroleum, and a good deal of wolfram, and some silver and lead.

Mineral Oil.—In recent years oil is being more and more used as fuel, both on land and sea, and many ships now burn it instead of coal. Our age is sometimes called the Oil Age. It is pumped up from holes bored in the earth. The most important oil-wells are in the United States, where thousands of miles of pipes carry it from the wells to refineries, from which it is sold to manufacturers for smelting iron, making glass, etc. Mexico now exports large quantities. In Asia there are many oil-wells near the Caucasus Mountains, the most important of which are at Baku on the shore of the Caspian. Much oil is now exported from Basra, from wells in Persia. In India we use a great deal of oil, refined in Rangoon, to which it is brought by pipes and river-steamers, from oil-wells far up the Irrawaddy. The Dutch East Indies, Java and Sumatra also supply large quantities. In Africa the oil-wells of Egypt are the most important. In the Empire there are at present not many rich wells. Burma and Assam, the Island of Trinidad, and Canada supply most, but many regions have not yet been searched for oil.

Products of the Sea.—In all countries with a coast salt is made from sea-water. From the sea man obtains large quantities of food.

Fisheries.—Fishermen are at work on the coasts of most countries. The chief fishing-grounds of the world are, however, in shallow seas. The most important are on the Banks of Newfoundland and other shallow waters round the mouth of the St. Lawrence, in Canada. Another rich fishing-ground is the shallow North Sea, where hundreds of steamers are employed night and day catching fish and bringing them to markets in Great Britain. The fishermen of Norway also catch large quantities among the islands of their coasts. In Asia the chief fishing-grounds are the shallow seas round the Japan Islands. In India the chief sea fisheries are on the Madras, Travancore and Bombay coasts, but they are only beginning to be developed. India could obtain a great deal more food from the sea than she does.

CHAPTER XXIV.

HOW MAN HAS MADE THE EARTH HIS DWELLING PLACE.

We have now learned that the surface and the climate of our world are not everywhere the same. On our globe live thousands of different kinds of animals and plants, but everyone knows that the plants and animals of one part of the world are different from those of another. The earth is also the home of man. But he does not live the same kind of life in all parts of it. Just as some animals are good climbers of mountains, others are flat-footed and roam over wide plains, others live in forests and climb the trees, others fly in the air or swim in the sea, so man does not live in quite the same way in all parts of his home. He uses the plants and animals to serve his purposes. But, unlike animals, he learns better ways of making his home a more suitable dwelling place. At first he lived by hunting for fruits and nuts and even roots of plants. At the present day only few people live a life of this kind, but in hill jungles in India and in other parts of the world we still find some tribes who do so. On rivers, lakes and sea coasts in all parts of the world men procure food by fishing. In those parts of the world where wild animals abound we find many people engaged in hunting. They usually live in separate families, for each man needs a large area for a hunting-ground. When man turns from hunting and killing wild animals to breeding and rearing grass-eating animals which he has tamed, he has made a great advance, for from such animals he can get almost all he needs. We find such people living in the grass-lands of the world. But when man learned to till the ground and grow

plants for his food and clothing, he made the greatest advance in civilization. Gradually he learned what plants were best suited to the soil and climate of each country, and how the work of agriculture could best be carried on. He has improved certain grasses till they have become important food crops such as rice, wheat, barley and millet: he has by cultivation turned poor, sour, wild fruits into juicy nourishing fruits. He has also learned how many other plants can satisfy his needs. Then, too, he has discovered how, not only the clay and rocks, but the minerals he digs up, can help him to make a thousand things which, without their help, he could not make. Last of all, when men began to trade with one another, at first between one village and the next and then between distant parts of the world, they made a still farther advance, for they learned how they can best help each other, and much more about the world in which they live.

Life on Mountains and Hills.—Let us see some of the ways in which the lives of different people differ. In the high parts of the world we find few inhabitants. The tops of the loftiest mountains are covered with snow and ice, where it is too cold for any plant or animal to live. Even on hills the soil is shallow; it is constantly being washed away by rain into the valleys and it is full of rocks. On such steep and rocky slopes ploughing is very difficult, and we see no fields or gardens. Grass and trees are here the chief plants. The people live by grazing cattle, cutting down timber, or perhaps making charcoal in the forests. Enough food to feed many people cannot be grown. People living among mountains have a hard life. Wherever they go, they must climb up or down steep rocky slopes. They live in small groups in valleys separated by hills. Sometimes the language spoken in one valley is different from that spoken in another. It is difficult for such people to join together to worship at the same temple, meet in the same market, or to help each other to build towns or to make roads across their mountains and bridges over their swift-flowing rivers. They are cut off from the rest of the world, and seldom see strangers from other districts. Thus, if we visit mountains

and hills, we find the people there are not so civilized as the dwellers in the plains. Many of the hill tribes in India are very backward. Most of them are not Hindus. They worship the spirits living in trees and rocks and streams. Their customs and their dress are not the same as ours. Many of them live on the fruits and nuts they find in the forests. Some of them, like the Todas of the Nilgiri Hills, have not even learned to till the ground. Hardly one can read or write. Many such tribes have no written language.

Mountains in most parts of the world are clothed with forests. They are high enough to catch the rain-clouds even in countries where but little rain falls, so that there is enough moisture to help trees to grow. Again, on mountains it is not worth while cutting down trees, because it is difficult to grow crops on the steep slopes and to take the timber to places where it is wanted. It is very important for a country that its mountain forests should not be cut down, because they retain the rain that falls on the slopes and keep it from flowing quickly into the rivers that drain them. These forests are Nature's sluices which regulate the supply of river water. If forests are cut down, the rivers are quickly flooded and the mountain slopes are denuded of soil.

Again, in many parts of the world, mountains contain large deposits of useful minerals, such as gold, silver, copper, lead, zinc and iron. The chief mining districts in North and South America are in the Rocky Mountains and the Andes.

Man has also learned to use the force of mountain streams to drive turbines which generate electricity. All countries with mountains are now trying to use the rivers which flow from them for this purpose. There are few coal-mines in India, but her mountains and rivers may one day supply her with all the "white coal," or water-power, she needs to make her a manufacturing country. The force of the rivers that come from the Himalayas could drive thousands of engines. The Tata hydro-electric scheme, which stores in large tanks the rain carried by the monsoon on to the Western Ghats and then sends it down the slopes in pipes to drive turbines, is one

of the greatest water-power undertakings in the world. The electricity thus generated drives the mills and lights the streets of Bombay city.

Life on Plains.—It is quite different in low-lying plains, broad river valleys and flat deltas. Here plenty of food crops can grow and people are not separated from each other. There is plenty of water and the soil is deep and fertile. Fields are everywhere and we see many villages and towns. We must remember that valleys and plains and deltas are made by rivers. They have for long ages been preparing a dwelling-place for man. Rivers work as man's Gardeners. Like gardeners they have levelled the land by spreading their silt over the plains during floods, year after year. For miles on either bank of the large rivers of India the land is flat. This flatness makes ploughing easy. The rivers also mix the soil. By the help of their feeders they wash down mud, clay, sand and lime from their upper valleys, mix it together and strew it on either bank. This work has been going on for thousands of years and so the soil of plains and deltas is deep. Every flood brings down fresh silt which is like the manure we spread on fields. Besides this, rivers water the land. The plains of our Brahmaputra and Ganges, of the Irrawaddy in Burma and of the great rivers of China are the most fertile parts of Asia. Here more food is grown and more people live than in any other. In most hot countries much of the rain is sucked up by the sun's heat ; much of it flows off the surface of the ground into rivers which carry it away to the sea. It must be stored up : if this is not done, a great deal of it is lost. This work of storing up water and using it for growing crops is called **Irrigation**. It is most easily carried on in gently sloping plains. Without irrigation India would not produce half the crops it does. One of the best ways of storing up water is to build **dams** or **anicuts** across rivers to keep the water from flowing away. Canals and small channels are dug from the deep water above the dam to lead it away and spread it for miles among the fields on either side. By means of sluices the flow of this water is regulated. It is not wasted : only so much water as the fields need is

allowed to escape from the river. The huge anicuts across the Godavari and Kistna irrigate very large tracts. Another way of storing water is to build bunds of earth and stones across the lower ends of hollows and small valleys, to catch the rainfall and the water from small streams. Water channels lead from these **tanks** to the fields below. In most parts of India, away from the large rivers, almost every village has one or two tanks near it. Even the water which sinks deep into the ground is made use of. **Wells** are dug to reach it. These wells are sometimes fed by underground springs or by water flowing underground from rivers. In the dry season, when many rivers are dried up, wells are dug close to their banks or in their beds, to catch underground water.

Besides being Gardeners, many rivers are useful Carriers of people and goods from one part of their plains to another. Flat-bottomed steamers can sail for hundreds of miles up the Ganges, Brahmaputra and Irrawaddy. On almost every Indian river boats and rafts are used. Rivers have helped man in still another way. By levelling the plains they allow railways and roads to be easily made across them. Most of the railways of India and of other countries have been made along river valleys. A railway map shows this very clearly. Mountains keep people apart. Rivers, roads and railways help them to meet. Across the Himalayas no railways and only a few mountain paths have been made. Many Indians have visited distant Europe or Africa. How very few have ever been in Tibet ! When people are kept apart, they are unable to learn things from one another. But if they can mix with their neighbours, and trade with them, they advance in civilization. This is why great centres of civilization have grown up in wide and fertile river valleys. Hinduism arose on the banks of the Indus and Ganges. The Chinese say they first became civilized when they left the mountains and made their home in the plains of their great rivers. Mesopotamia, the land of twin rivers, was, long ago, one of the richest countries of the earth with famous cities. Without "Father Nile," Egypt would be a desert. That country was once the most

civilized in the world. At the present day the Indo-Gangetic plains, owing to their deep and fertile soil, their many rivers, roads and railways, their hundreds of villages and many large towns, are the most important part of India. Deltas, like the flood-plains of rivers, are much used by man when they are raised high enough not to be swampy. The deltas of our Ganges and Brahmaputra, Mahanadi, Godavari, Kistna and Kavari, of the Yangtze and Hwang Ho in China, of the Po in Italy and of the Rhine in Holland and Belgium are among the most densely peopled parts of the earth.

Life on Sea Coasts.—Sea coasts are also suitable dwelling places. Very few are desert, because the winds easily bring rain to them from the ocean. The sea is a storehouse of food. It provides man with salt and fish. On sea coasts and islands all over the world, many people earn their living as fishermen. The fish we eat do not live in deep seas. They like shallow water, for there they find most food. All along the coasts of India the sea is shallow for miles out from the shore, and these waters are, therefore, a suitable breeding-place for fish. Thus, all along our coasts there are hundreds of fishing villages. It is the same on the sea-shores of other countries all over the world, where we see villages full of fishermen and harbours where they keep their boats. From these harbours the fish are sent to inland towns. The Eskimos of the far north and the islanders of the Pacific Ocean live almost entirely on the harvest of the sea. The people of Newfoundland depend as much on the fish they catch as on the crops they grow. The shallow waters of the North Sea in Europe are the most famous fishing ground in the world. Here hundreds of boats from the countries on its coasts are daily and nightly busy with their nets and lines. The fish caught in other seas are not the same as those we get from the Arabian Sea or the Bay of Bengal.

People who live on coasts learn to love the sea. In storms their boats and ships have to fight against the waves and currents. This teaches them to be brave and adventurous. Gradually they make longer and longer voyages from their

own harbours and explore distant seas, islands and continents. In Asia, the fishermen of the Malay Straits, of the China Sea and the Persian Gulf were the first navigators. In the Pacific the Polynesians were forced to become sailors in order to pass from one group of islands to another. But it was on the coasts of the Mediterranean Sea that men learned best how to become sailors, navigators and merchants. The coasts of the Baltic and North Sea also bred a brave race of seamen. All the great sea-nations of the past have lived on the shores of seas belonging to Europe. The Japanese, whose home is a group of islands, are also famous fishermen and sailors.

Life in Very Cold Countries.—The kind of life people lead in different countries depends also on climate. In very cold regions of the world scarcely any plants can grow, and, therefore, few people can live. On the small continent marked on the map round the South Pole there are no inhabitants at all. It is a world of ice. In the countries bordering the Arctic Ocean there are very few. Scattered tribes of Eskimos dwell in cold Greenland and on the northmost shores of North America. There are four times as many people in Poona or Madura as the whole number of the Eskimos. The reason is easy to understand. The land can grow no crops. For many months of the year it is frozen and covered deep with snow. The milk and flesh of their reindeer and the fish they catch in the sea are their only food. For fuel they burn the fat of seals or the driftwood they find on the shore. Life in such a cold barren country is very hard. We cannot expect such people to be highly civilized. They have no roads nor railways, no towns, no schools, no hospitals. Their life is a constant fight against cold and hunger.

Life in Deserts.—Again, in very dry parts of the world very few plants can grow and, so, few animals can live. There is not enough food to feed many people. Only in green spots (called oases), in these deserts, where a few springs give water or wells can be dug, can people live. In these oases we find a few villages under the date-palms and a few crops. But over the rest of the country there is nothing to eat. The villages in

these oases are separated from one another by miles of sand and bare ground. The people find it difficult to meet together. They are cut off from each other and so they remain very backward. Without the camel, which can travel for long distances without water, life in these deserts would be impossible. The Thar Desert and the rainless districts of Sind are the most thinly peopled parts of India. There are more people in Bombay than in the Great Sahara Desert of Africa, which is much larger than the whole of India.

Life on Grass-lands.—In those countries where rain falls only for a short season and only grass can grow, people live the life of shepherds and herdsmen, dwelling not in houses or villages but in tents, moving from place to place. When their flocks and herds have eaten up the pasture in one district, they pack their tents and all their belongings on the backs of horses, bullocks and camels, and with their families move off to other grazing grounds. In the winter season they keep to the sheltered valleys. In the warm season, when the snow has melted on the hills, they take their cattle up to the higher slopes. Such people are called nomads or wanderers. Their animals are their only wealth and supply all their needs. Their life is quite unlike that of people who live on wide fertile plains and deltas, where men live in villages and hamlets in the midst of their fields.

Man's Helpers.—Man has also learned what animals to breed. Horses, cattle, donkeys, sheep and goats are the chief of these. In very cold countries reindeer and dogs are trained to drag sledges over the snow. On the Himalayas strong shaggy bullocks (yaks) are used to carry loads over the steep slopes, even among the snow and ice. In the Andes Mountains the people have trained an animal, half goat half camel, to do this work. The camel with a store of food in its hump and of water in its stomach, can travel across the desert for days without food or drink, and its padded feet do not sink deep into the sand.

CHAPTER XXV.

HOW MAN HAS MADE THE EARTH HIS DWELLING PLACE (Continued).

Manufactures.—Many people live not by hunting or fishing or grazing animals or growing crops, but by making things. Even in a village we have carpenters, smiths, weavers and potters. In order to make things we need tools. By the use of machines man can make tools do work a hundred times faster than he could without them. Every year some new machine is invented. These tools and machines are made of iron and steel. Man has also discovered he can make use of forces far greater than his own strength to drive these machines. One of these forces is steam. To make steam we need coal. Therefore, in places where coal, iron and other metals are mined, many people are engaged in manufactures. This work is carried on in large factories and workshops where steam-engines drive machines, manufacturing goods out of cotton. wool, jute, silk, iron, wood, leather, etc. In manufacturing countries, such as England or Belgium, most of the people live a different life from that of an agricultural country. The land is dotted over with large towns full of mills and factories, where thousands of men, women, boys and girls are busy all day. The air is darkened with smoke from the tall chimneys. In India there are few coal mines or iron mines, and so we have few large manufacturing towns. The chief business of India is agriculture.

Trade and Commerce.—Other people live, not by making things, but by buying and selling them and carrying them from place to place—by trading and commerce. Even in a

village we see some things which are not grown nor made near it. By means of money people exchange the things they grow or make for other things which they cannot grow and do not know how to make. These things may come from other parts of our province or of India, or from countries oversea. In any village we can buy salt, kerosene oil or matches. The salt, made on the sea coast, is sent to inland towns and villages by road and railway. Steamships bring the oil across the Bay of Bengal from Burma, where it is pumped like water from wells. Iron tanks full of it can be seen at railway stations. Matches come by sea from other parts of the world.

This work of trading needs thousands of men. It goes on night and day all over the world. Over our province and the other provinces of India there are thousands of miles of road. Even the smallest village has a road or path joining it to the next village or town. The map shows the large, and many of the smaller, towns of India are joined by railways. They have been made by the easiest routes and so we find them running across the broad plains and flat sea coasts. Across the tablelands there are fewer lines, and there are hardly any over the steep slopes of hills. No railway has yet been built across the mountains that separate India and Burma from other countries. On the rivers and canals of India, just as of other countries, there are thousands of boats, and each boat has its crew, doing this work of trading. Last of all, there is the great ready-made pathway of the sea, with stopping places, called seaports, along its coasts.

The work of trading by road, railway, canal, river and sea needs thousands of men. In exchange for goods brought from other parts of India, or from abroad, other goods are sent. It is just the same all over the world. People of different towns and provinces and countries exchange goods. Every country sends abroad the crops and fruits it can grow best, the coal and iron and copper and silver dug up from its mines, and the things it can most easily make. In return it receives from other countries the things they can most easily make, the minerals of their mines and the fruits and crops they grow. The more

a country has to sell of what other countries want, the more it can buy from them.

Sea-trade.—If the climate and soil of a country can produce easily things wanted by other countries, or if it has rich mines of iron or coal, or if it can make cheaply those things which are much desired by other countries, it is sure to have a large sea-trade, especially if it has good roads and railways or navigable rivers and safe harbours to make this trade easy. Jute is a plant which grows better in the damp soil and hot climate of Bengal than in any other part of the world, and this jute can easily and cheaply be brought to Calcutta harbour in boats and by rail. Therefore, Calcutta has a larger jute trade than any other town in the world. Rangoon lies at the sea end of a long fertile valley, with forest-covered hills on either side and with many petroleum wells in it. Rangoon, therefore, exports large quantities of teak floated down the Irrawaddy, of rice carried to it in paddy-boats, and of oil brought down the river in flat-bottomed steamers. Karachi had not much trade till railways were built up the Indus valley to join it to the fertile wheat lands of the Punjab, irrigated by canals from the Five Rivers. Now it exports hundreds of ship-loads of wheat every year.

Means of Transport.—In carrying goods from one place to another man uses different means. Thus, in the dense forests of the world through which animals cannot make their way, paths are cut and men themselves are the carriers; over steep mountains sure-footed mules are found most useful, and yaks are used on the Himalayas; in deserts, camels are the only animals which can travel for days without food or drink; reindeer and dogs are harnessed to drag sledges over the snows of the cold tundras. Such means of transport are, however, slow and costly, and in countries where they are used there is but little commerce.

In places where roads can be made carts are used, but these roads are often very bad. Now that motor cars and motor wagons are being used for commerce, roads are being improved and extended. Railways have opened up many countries to

trade. Trains dragged by engines driven by steam or electricity can carry large quantities of goods quickly from place to place.

It is, on the whole, cheaper to carry goods by water than by land for two reasons. First, it is easier to drag a boat than a cart of the same weight; secondly, it costs less for the upkeep of a water road than a land road. Rivers, lakes and the great seas and oceans afford easy routes, and their upkeep costs little or nothing. At first the power of the wind was used to drive ships. Nowadays most ships are driven by steam. A large modern steamship can sail 500 miles in twenty-four hours, and carry as many goods as a dozen trains, and much more cheaply. Canals can be made to join rivers or seas; rivers can be deepened or made into canals.

Ocean Trade Routes.—In the case of sailing ships the easiest way is to follow the course of prevailing winds and ocean currents: the shortest route is thus not the one we trace on the map. In the case of steam-ships many sea routes were shortened by the cutting of the Suez Canal, so that now more traffic goes by that way than round the Cape of Good Hope. The most important ocean routes at present are those between Europe and North America, with the ports of London, Liverpool and Antwerp on one side and New York on the other. Next comes the sea route from north-western Europe through the strait of Gibraltar and the Suez Canal. After reaching the strait of Babel Mandeb this route divides. Some traffic goes north to Bombay and Karachi, some southward along the east coast of Africa, and some, touching at Colombo, south-eastwards to Singapore. Here the vessels going to Japan and China turn north-eastwards. The routes across the Pacific pass from China and Japan ports to San Francisco and Vancouver or Valparaiso.

Rivers are of course not such good waterways for trade as the broad, deep sea. Some are too shallow except for small boats; others dry up in the hot season; others block up their mouths by sand-bars or deltas like the Indus. Other rivers, in cold countries, are blocked by ice for some months. Although the rivers of Eastern Europe and the St. Lawrence and Great

Lakes of North America carry a great deal of water traffic during most of the year, yet they are useless for many weeks in winter. Some large rivers flow into inland seas (*e.g.* the Volga into the Caspian) and others into the Arctic Ocean (*e.g.* the rivers of Siberia), which, owing to ice, is not used for sea-trade. Such rivers, therefore, do not form part of the natural trade routes of the world.

Land Routes.—The land is not level like the ocean, and it is always difficult and costly to make roads and railways over hills and mountains. Thus they usually make use of river valleys in crossing higher ground, and avoid the high land by keeping to the flat coast. This can be seen by a study of the railway map of India. When a road or railway is built across a range of mountains, it is usually made through a pass, *e.g.* the Palghat Gap, which joins the head of a valley on one side to the head of another valley on the other. If, however, a pass is very high or the slope of a valley very steep, a tunnel is sometimes made under the mountains.

Air Routes.—In recent years man has invented machines to carry him through the air faster than any bird. An aeroplane can fly with three times the speed of an express train. An airship has flown from England to America in a few hours. Air voyages have already been made across the world from Europe to Australia. Airships have been built to take the place of steamships and railways, carrying passengers, letters and goods. The route from England will probably be from London to Marseilles in France, then across Italy to Athens in Greece, then across the Mediterranean to Cairo in Egypt. From Cairo some vessels will fly southwards across Africa to Cape Town. Those coming to India will strike eastwards across the desert to Basra and then along the coast to Karachi. From Karachi an air-voyage of only one day will take them past Delhi to Calcutta. From Calcutta the voyage can be continued through Rangoon to Singapore and Java, and from Java on to Australia. In 1924 two American airmen flew right round the world. On their way they passed through Karachi, Delhi, Calcutta and Rangoon.

CHAPTER XXVI.

HOW MAN HAS MADE THE EARTH HIS DWELLING PLACE (Continued).

Growth of Towns.—We have seen that in manufacturing countries most of the people live in large towns. In England more than two-thirds of the people are dwellers in towns, where they spin and weave cotton and wool, make all kinds of tools and machines, or build ships. Cawnpore and Bombay are towns of this kind. In India such cities as Delhi, Agra, Ahmadabad, Madura and Trichinopoly were built round the camp or fort of some chief. Here workmen and merchants settled with their families for protection. At a place where roads, rivers or railways meet a village may grow into a town, *e.g.* Patna, Allahabad and Jubbalpore. From the earliest times people in India have made their homes on the banks of rivers, and when these rivers changed their courses the people had to follow them. No river in the Indo-Gangetic Plain but has changed its course a hundred times over. Thus, all over this plain we can see old mounds, lines of ruined cities and crumbling forts which tell us where rivers once flowed. This wide plain is, therefore, a land of deserted villages and towns.* In India (as in other countries) sacred spots, such

* Quite recently on the banks of the Indus, deep under mounds of earth and bricks, the ruins of old cities have been discovered. They are the remains of an ancient civilization—the oldest in India. We now know that the very earliest dwelling places of civilized men were on the banks of the Indus, just as we knew before that, very long ago, civilized men lived in towns on the banks of the Euphrates and Tigris, of the Nile and the Danube.

as Benares (Kasi) Madura, Nasik, Allahabad (Prayag) and Puri, have grown into towns. So, too, towns grew up at important points on trade-routes. Multan, Peshawur and Shikarpur are places where merchants start with their camels going from India to Baluchistan and Persia. Leh, Naini Tal and Darjeeling are the starting-places for merchants crossing the Himalayas by passes into Tibet. At Bhamo the trade-route from China meets the great waterway of the Irrawaddy.

Harbour Towns.—But the most important trade towns are on the sea-coasts, for here the trade of the land meets the trade of the sea. Where a coast is broken by deep inlets or navigable river mouths or by islands behind which ships can shelter from storms, there harbours are made and towns grow up round them. The coast of Africa is but little broken and ships cannot sail up its rivers, and so it has very few natural harbours. In Canada, on the other hand, the coast-line is very broken, and the St. Lawrence gives a waterway for steamers right up to the Great Lakes. Here, therefore, we find many busy ports. At the present day sea trade is carried on in steamers which need deep water, say 20 or 30 ft., to float them. Thus the Ranns of Cutch, the Pulicat Lake and the mouths of most Indian rivers are useless as harbours. The Hughli and Rangoon River, helped by the tide, are the only openings up which such vessels can sail, and, so, Calcutta and Rangoon are the only first-class river-ports in the Indian Empire. Bombay harbour is protected from storms by an island; so is Karachi. At Madras, huge, thick walls have had to be built, like arms, into the sea to allow these big vessels to lie in deep and calm water inside them. Except in these few harbours, vessels must anchor some distance off the ports and load and unload their cargoes with the help of boats. This is a great disadvantage to the sea-trade of India.

Calcutta.—Large sea-trading towns must have more than deep and safe harbours. They must have behind them a fertile or manufacturing country easily reached by road, river

or rail. The map shows why Calcutta is such an important place of trade. It stands on a very large and fertile delta, crossed by many rivers and creeks. On these waterways thousands of boats carry the crops grown on the delta to its markets and harbour and bring back the goods landed there from foreign countries. Behind Calcutta the largest and most fertile plain in India stretches right up to the north-west frontier on the one side and to the head of the Brahmaputra valley on the other. Along this flat plain roads can easily be made, canals can be dug and railways cheaply built. It costs much less coal and money to drag a train of wagons over a plain than up and down steep slopes. Besides, the Ganges and Brahmaputra, as well as their feeders, as they flow through a flat country, are easily navigable by boats and steamers. Calcutta is, therefore, very well suited for trade. It stands at the place where the roads, railways and waterways of the land meet the great highway of the ocean. It is the mart where the crops grown on the plains and hills are exchanged for the produce and manufactures of other countries.

Bombay.—Bombay is another example of a great trading town and seaport. Its harbour, protected by an island, is the best in India. Here steamers can load and unload their cargoes in safety, even when the monsoon storms are blowing. As the map shows, it is much nearer than Calcutta to Europe by the Suez Canal route. It also lies close to the fertile cotton-growing districts, and this has made it the chief centre of the cotton-spinning and cotton-weaving industry in India. It exports the yarn and cloth to Africa, China and Japan. True, unlike Calcutta, it has not a flat, easily reached country behind it, for the Western Ghats cut it off from the mainland. But this difficulty has been partly got over by building railways through tunnels and across passes in these mountains to join it with the rest of India.

If a seaport has a wide fertile country behind it, the greater will be its trade. Shanghai, Marseilles, New Orleans, Buenos Aires are other examples. It may have grown up because it is an important place on an ocean route. Colombo is a busy

seaport, not because Ceylon has a large sea-trade, but because the harbour is a meeting place for steamers making voyages across the Indian Ocean, and a coaling station. In the same way the trade of Singapore has grown owing to its position. Port Said is the stopping-place of all vessels passing through the Suez Canal. But for the canal there would be no Port Said, just as, till railways were made, there was no Karachi. The towns at either end of the newly made Panama Canal are bound to become important.

Tides also help Harbours.—Twice every twenty-four hours the attraction of the sun and moon causes a wave of high water, called a tide, to go round the world. In open oceans this wave is only a few feet deep. But in estuaries and at the mouths of rivers this tide is sometimes twenty feet deep. Now the tide can lift a thousand ships as easily as it can lift a dead leaf. The result is that it can carry vessels into and out of estuaries. At Calcutta and Rangoon there is a tide of this kind. When the tide is flowing up the Hughli river, you can see it carrying hundreds of vessels and large boats up to Calcutta harbour, and when the tide is ebbing, *i.e.* running out, hundreds of other vessels use it to carry them out to sea. Without this tide Calcutta would have very little sea-trade. In Great Britain, where the tides are deep all along the coasts, harbours have been built on estuaries, and large seaports have grown up round them.

Towns and cities do not grow up by chance. There is always a reason why they are built in one place and not in another.

POPULATION OF THE WORLD.

The coloured map at p. 240 shows where the population of the world is dense and where it is thin.*

The parts marked white and light-yellow in the far north have few people, because there it is very hard to live owing to

* For details of India, see map on p. 272.

the cold. Scarcely any plant can grow, and the only food is fish and the flesh of seals. There are fewer people in Greenland than in Madras or Delhi. On the land round the South Pole there are no inhabitants at all.

In the dry and desert parts of Asia (including India), of Africa and Australia, and in the smaller deserts of North and South America, there are also few people, because few food plants can be grown. There are here no large towns. Only in the oases and in places near the few rivers do we find some scattered villages. In large parts of the Thar, the Sahara, the Gobi, the Kalahari, and of the Central Desert of Australia there are no villages at all.

The part of Africa south of the Sahara marked light-brown is not desert, and yet it is thinly peopled. In the basin of the Congo much rain falls, and here the land is covered with forests. In forests only few people can live. Farther south we come to grass-lands, where people live by pasturing cattle and the villages are widely scattered. Besides, in Africa, large numbers of the people are still uncivilised. They only grow a few crops. Till lately they were continually killing one another in fierce wars, and many died of disease. None of this part of Africa is carefully cultivated to grow rich crops like the deltas of India. These are some of the reasons why the population of Africa is not dense. The wetter, Pacific, side of Australia and New Zealand are also marked light-brown. The reason is that these are new countries. They never had many people and the original inhabitants are dying out. These regions are peopled by immigrants from distant Europe, and the population has grown slowly. The spots of brown are round the few large seaport towns, such as Sydney and Melbourne (Fig. 164).

In South America, too, the population is not dense. It is thinnest in the desert parts and in the marshy unhealthy forests of the Amazon basin. Most of the regions marked yellow are pasture lands, and in pasture lands population is never dense. A few spots round the coast are marked darker-brown where seaport towns have grown up.

In the western regions of North America the population is still

very scattered. The reason is that a large part of them is taken up by the Rocky Mountains and by the grassy prairies to the east of them. Here people live by pasturing and farming. The eastern half of the United States is, however, fairly thickly peopled. Every year thousands of immigrants reach its Atlantic ports from Europe. Besides, in this part there are rich coal, iron and copper mines and oil wells, so that large manufactures are carried on and hundreds of large cities have grown up. In this part of the world population is growing very rapidly.

The map shows the most densely peopled parts of the world are (1) the Monsoon Lands of Asia and (2) Europe, including the British Isles. There are about 1600 million people in the world, and about half that number live in the monsoon countries. The reason is that the good rainfall makes them very fertile, so that plenty of food of all kinds can be grown. The chief food is rice, and paddy gives a bigger yield of food per acre than any other crop. The Nile valley is thickly populated because the river irrigates its fields.

In Europe the population is also dense, but for another reason. Here, helped by coal and other minerals, manufacturing of all kinds has been longest carried on. There are thus very many large manufacturing towns and districts. When people are engaged in manufactures, they live close together near mines, factories, mills, harbours and railway stations. When they are shepherds and farmers, their homes are more scattered.

RACES OF MANKIND.

At p. 240 is a map showing where the chief races of mankind live. Though the human family is one, yet it can be divided into three main races. Of these races there are many subdivisions, which have been caused by intermarriages, by climate, by food, and by habits and customs. In India we find many such subdivisions. But among them all we find three main types which differ from one another partly in the size and shape of the skull and face, partly in the hair, and partly in the colour of the skin.

1. The parts of the world where the **Caucasians** live are marked red on the map. They get this name because they were formerly believed to have first come from near the Caucasus mountains between the Black Sea and the Caspian. From that centre they wandered off in different directions. One important branch more than 4000 years ago entered India, colonised it and converted the people. The highest castes of Hindus are certainly of this race, but many, as time went on, married with the people they found in their new home. The Dravidians in the south of India also, it is believed, came from the north-west. Of the original inhabitants we find examples among the half-civilised peoples in the Ghats and other mountains. The map shows that other tribes of Caucasians spread into Europe, and now the people of that continent are nearly all of this race. Others spread into Persia and Arabia, and, by the help of camels, across the north of Africa. A few wandered eastwards, and occupied a narrow strip across the middle part of Asia as far as the coast of the Japan Sea. In recent years they were helped to do this by the Trans-Siberian railway. After the New World was discovered, colonists from the European peoples of this race crossed over the Atlantic, and gradually spread westwards from the eastern to the Pacific shores of the North American Continent. The climate there suited them and they found the soil was fertile, so they increased in numbers very quickly. Others, mostly Spaniards and Portuguese, conquered parts of South America and settled there, chiefly on the parts near the coasts. Still others, mostly natives of the British Isles, settled in Australia, New Zealand and in South Africa.

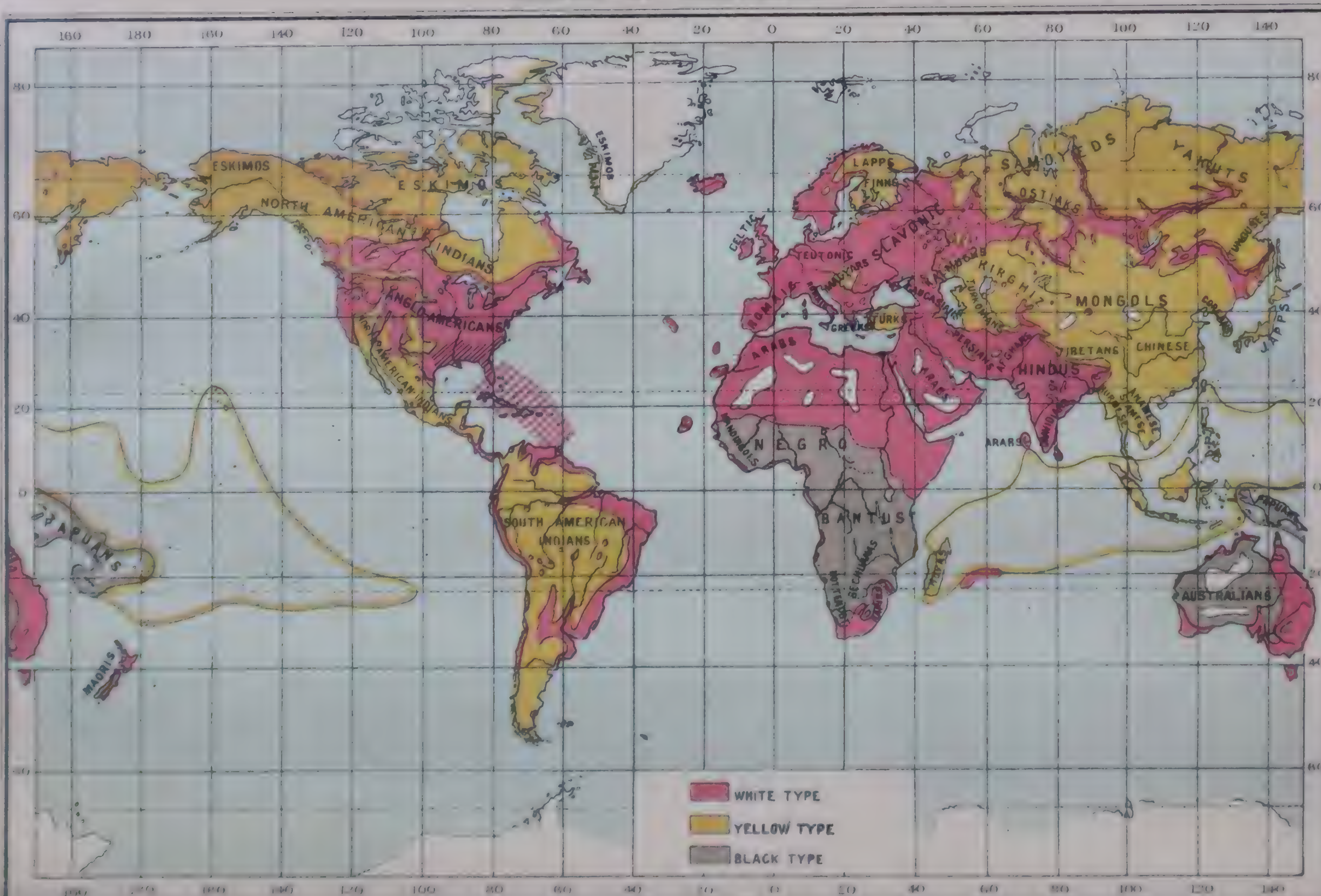
The chief marks of the Caucasian are an oval face, a high-bridged nose, a lower jaw nearly in a straight line with the rest of his face, and eyes in a straight line. His hair is wavy or curly, especially in childhood, and not woolly ; nor is his skin black like that of the negro. Those Caucasians who live in cool countries have a white skin, and their eyes are often blue, *e.g.* the Teutons. Those who now live in warmer countries have become dark or brown from long residence under a hot

sun. The peoples of Southern Europe, *e.g.* the Italians, Spaniards and Greeks, are much darker than those of the north. In India similar differences are seen.

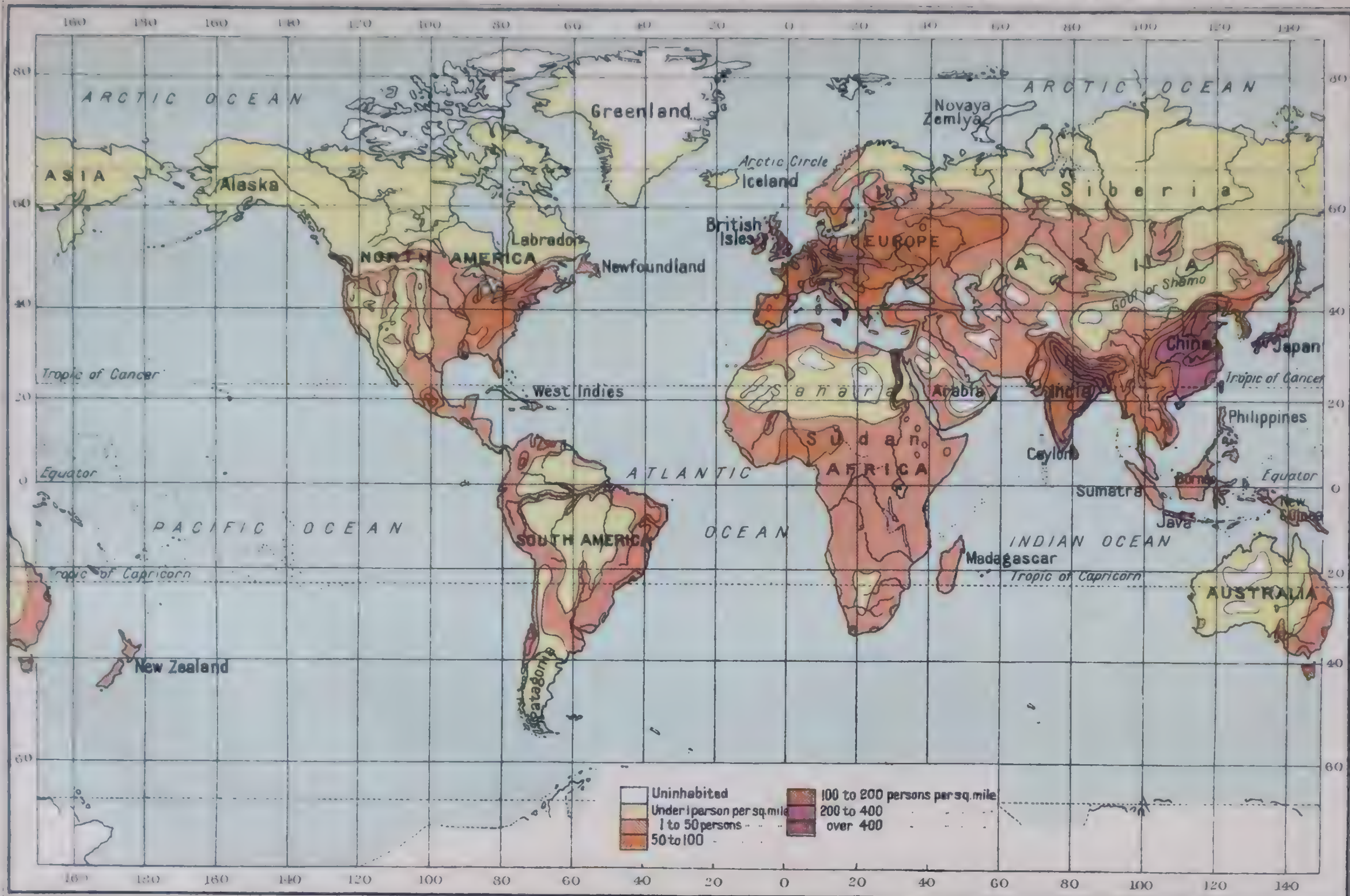
2. **The Mongolians** (or Yellow Race) live chiefly in Asia and in North and South America, but the population map shows that most of them are in China, Japan and the Indo-China peninsula, including Burma. The Chinaman is a good example of the Mongolian. One or two of them can be seen in large towns in India. He has a broad face with high cheek-bones, almond-shaped slanting eyes and a broad nose. His hair is black and straight, not wavy or curly. The pictures of Japanese and Kirghiz in this book show us how they differ in face from the people of India. The South American 'Indians,' though of the same Mongolian race, do not resemble them closely, as, for thousands of years, they have lived in a different part of the world with a climate of its own. The North American 'Indians' are even more unlike the Chinese type of Mongolians. They are taller, stronger-looking, with high-bridged noses, and their skin is of a dark red, copper colour. It is believed they are a branch of the Mongolian race of Asia which crossed the Bering Straits long ago. They seem to be dying out. The Polynesians, *i.e.* the islanders of the Pacific and the natives of the East Indies, also belong to this race, but their skin is brown rather than yellow.

3. **The Negroes** or Black Men.—Their home is Africa, but there are different types of them just as there are of other races. The map gives the names. The skin of the negro is black, his nose flat, his lips thick ; his lower jaw projects from the line of his face, and his hair is woolly like the coat of the sheep. In the days of slavery negroes were caught and brought as slaves to Arabia and India. Large numbers were also shipped across to the sugar plantations of the West Indies and the cotton-fields of the United States. There they increased rapidly, and now about one-tenth of the people of the United States are negroes. The original inhabitants of Australia were also of this race, but they were always few in numbers and they are dying out.

RACES OF MANKIND



MAP SHOWING DENSITY OF POPULATION IN DIFFERENT PARTS OF THE WORLD



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CHAPTER XXVII.

EURASIA AND THE OTHER CONTINENTS.

(See coloured map and Figs. 64 and 119.)

Map Study.—Eurasia, which is made up of Asia and Europe is, as the map of the world shows, the largest mass of land on the earth's surface. Asia is about ten times the size of India and Europe about double. The other continents seem to be placed round Eurasia. **Africa** is separated from Europe by the Mediterranean Sea, and the two continents nearly touch each other at its western end where the narrow Strait of Gibraltar leads out into the Atlantic. From Asia, again, Africa is separated by the long narrow Red Sea. At its southern end these two continents come close to each other at the narrow Strait of Bab-el-Mandeb, or Gate of Tears, leading out to the Indian Ocean. At the other end of the Red Sea they are joined by the narrow, low isthmus of Suez. About fifty years ago the Suez Canal was dug across this sandy neck of land, so that ocean steamers can now pass from the Mediterranean through this waterway to the Red Sea and on to the Indian Ocean.

Again, at the north-east corner Asia reaches very close to the continent of **North America**, from which it is separated by the Bering Strait, full of ice and often covered by fogs, which leads from the Arctic Ocean to the Pacific. Only at this point does Asia approach America; its long eastern coasts are separated from the western coasts of America by the immensely broad and deep waters of the Pacific.

Australia, a large island-continent, lies far to the south-east of Asia on the other side of the equator and on the map it seems as if it were joined to our continent by a broken bridge

of islands large and small. Europe and Africa are really much nearer to the continents of America than Asia is. A voyage across the Atlantic is much shorter than one across the Pacific.

COASTS OF EURASIA.

European Coasts.—First compare Europe with Asia. Both continents lie in the northern hemisphere but Asia stretches farther north and much farther south than Europe. Thus the northmost parts of Asia are colder and the southmost parts are much warmer than any part of Europe. The southern peninsulas of Asia lie within the Tropics but the whole of Europe is far outside them. The whole of India and of Burma lies much nearer the equator than the southmost part of Europe.

Again, the European part of Eurasia is much more broken up by arms of the sea than the Asian part. Thus few places in Europe are far from salt water; the coast line is very long and winding and there are many splendid sheltered harbours. This explains why the European nations became great fishermen, sailors and sea-traders. They have spread to all parts of the world which could be reached by sea to explore, to trade and to colonise.

Four great oceans wash the shores of Eurasia. It has many peninsulas but only in the European part does an ocean send long arms of sea far into the land. From the Atlantic Ocean the Baltic Sea pierces to the centre of Europe and its North Sea cuts off the British Isles from the mainland. In the south the long Mediterranean Sea has a very broken coast line on its European shores and forms three peninsulas—the Iberian (Spain and Portugal), the Italian and the Balkan—and many islands. At its eastern end this sea is joined by the Dardanelles Strait to the small Sea of Marmara from which the Bosphorus Strait leads to the Black Sea. Farther east the land-locked Caspian Sea forms part of the boundary between Europe and Asia. Thus the southern boundary of Europe from the Atlantic to the Caspian is,

nearly all of it, a broken coast-line. In the north the Arctic Ocean sends the long arm of the White Sea far into the land.

Asiatic Coasts.—Asia is very much larger than Europe. Like Europe it also has many peninsulas, but they take up, in proportion to its size, a much smaller part of the continent. Asia is much more solid and compact than Europe.

1. South Coast.—Indian Ocean.—Here there are three peninsulas which correspond, on a large scale, to the three southern ones in Europe. Corresponding to the Iberian peninsula (Spain and Portugal) we have the peninsula of Arabia with coasts on three seas. The coasts of both peninsulas are but little broken. Both are high dry table-lands. India matches Italy. It is a peninsula stretching south, separated in the north from a high range of mountains by a valley. Ceylon corresponds to Sicily. Farther east the Indo-Chinese peninsula, with its back-bone of mountains and its fringe of large islands, may be compared with the hilly Balkan peninsula with its groups of small islands.

2. East Coast.—Pacific Ocean.—We might almost say Asia has here two coasts—an inner mainland coast and an outer island coast, and between them lie the seas and gulfs and straits belonging to the Pacific Ocean. These must be studied from a good map. After rounding Cape Romania at the end of the Malay Peninsula we enter the South China Sea with its gulfs of Siam and Tongking and separated from the open Pacific by the island of Borneo and the Phillipine group of islands. Then we pass through the Strait of Formosa between that island and the mainland of China. This brings us to the Yellow Sea, half enclosed by the mountainous peninsula of Korea and the most southerly of the Japan Islands. We might compare it to the North Sea of Europe. Its inmost part is the Pechili Gulf, itself nearly enclosed by two small jaw-like peninsulas. Next, passing out through the Korea Strait we enter the Sea of Japan, lying between its outer ring of the Japan Islands and the mountainous mainland. At its northern end the Gulf and Strait of Tartary lead into the cold, foggy sea of Okhotsk, which is separated from the colder

Bering Sea by the Peninsula of Kamchatka and a string of islands full of smoking volcanoes. Of these seas the South China and the Yellow Seas are much the most important, for the map shows several large seaports on their coasts. The chief harbours of Japan lie on the outer or Pacific side of its islands not on the Sea of Japan. The Sea of Okhotsk and the Bering Sea are almost harbourless, for the shores are too cold for crops and are often blocked with ice.

3. North Coast.—Arctic Ocean.—This coast is but little broken and it is by far the least important, as the sea there is full of ice. Few people can live on it on account of the intense cold and no crops can be grown. Ships from other parts of the world very seldom visit it and there are no harbours. We only know about it from the stories of daring explorers. One, and only one, ship has ever made the voyage from the Atlantic to the Pacific by the Arctic Ocean. For a whole winter it was frozen in the ice, and only when summer came and the ice melted, did it safely reach the Bering Strait and sail into the Pacific.

THE GREAT HIGH LANDS AND THE GREAT LOW LANDS.

Map Studies.—But by the shape of Eurasia we mean more than its outline on the map. We mean its ups and downs, its mountains, hills, valleys and plains.

1. High Land of Eurasia.—We can see on the map that the high ground stretches right across Eurasia from the south-west corner of Europe on the Atlantic coast to the north-east corner of Asia on the Pacific coast. This high land, as the map shows, does not lie exactly across the middle of Eurasia, but rather to the south of the middle. It sends out high ground into all the peninsulas pointing south.

2. High Land of Asia.—The great bulk of the high land of Asia lies north of India and Burma. If we draw a line joining the west end of the Hindu Kush with the extreme east end of the Himalayas, and then join the ends of this line with the extreme north-east corner of Asia, we trace out a triangle.

Within this triangle lies the great bulk of the high land of Asia made up of mountains and table-lands. At the edges of the table-lands the ground slopes down to river-valleys and sea-coasts.

The highest part, we see, lies north of India. We know already that the Himalayas are the highest mountains in the world. But the Himalayas are not the centre of the high land, but only one of its edges. The central knot of the high land is the Pamir Table-land. Find it on the map. From this central knot other great ranges run. Notice carefully the direction of the Karakorams and Himalayas, the Kuen-Lun, the Hindu Kush, and the Tian-Shan ranges. North of the Tian-Shan are other ranges. The chief thing to notice is that all the land between and among the mountains is not low, but high. If we keep our eyes on the map, we can get a picture of this great lofty tract. It is an immense mass of very high land, filling up nearly one half of Asia. On the floor of this high land, which is higher than the highest mountains of Europe, there are many mountain ranges covered with snow. Between these ranges there are high valleys and high table-lands. Thus, between the Himalayas and the Kuen-Lun lies the great table-land of Tibet, nearly three miles above sea-level and higher than the highest mountains in the peninsula of India. Beyond the Kuen-Lun, again, is a lower table-land, called the Tarim Basin, named from the Tarim River, which flows through it into a lake called Lob-Nor. This great basin, or table-land, stretches far eastwards beyond the lake, right up to the Kinghan Mountains on its eastern edge. This is the vast table-land of Mongolia and part of it is the rainless desert of Gobi. At the eastern end of the Himalayas and of the table-land of Tibet we see ranges bent round and running parallel to each other into the peninsula of Indo-China. Trace a line from the southern end of the Caspian Sea to the north-east corner of Asia. This gives the general line of the mountains which form the northern edge of the high land.

3. Western High Land of Asia.—The high land stretches far westwards too. It fills up nearly the whole of Asia lying

between the Black Sea and the Caspian in the north and the Arabian Sea in the south. All this is high land and table-land but it is not nearly so high as Tibet or the Pamir high land. It is divided into three separate table-lands. (1) The table-land of Iran lies north of the Arabian Sea and south of the Caspian. The Sulaiman Mountains separate it from the Indus valley on the east; on the north its edge is formed by the Hindu Kush and the Elburz ranges. (2) Still farther west is the table-land of Asia Minor lying between the Black Sea and the Mediterranean. (3) The huge table-land of Arabia lies east of the Red Sea. It is very dry and barren.

4. High Land of Europe (see Fig. 118).—If we follow this high land of Eurasia into Europe, we find its position there corresponds, on a small scale, with its position in Asia. Just as the Himalayas are the highest part of the high land in Asia, so the Alps are the highest part of the high land in Europe. The Alps are made up of parallel ranges of folded mountains separated by deep and steep-sided valleys. They contain some of the loftiest peaks in Europe, hundreds of miles of ridges covered with snow and ice, and many deep blue lakes. They are the birth-place of some of the most important rivers in Europe. From them other ranges run out in different directions. One lofty, wooded range—the Carpathians—curves to the east in a great semi-circle. It encloses the Hungarian plain which is watered by the Danube. The three peninsulas of Southern Europe also form part of the high land. In the west the square-shaped Iberian table-land (Spain and Portugal) stretches out into the Atlantic. It is crossed by several ranges of mountains and is separated from the rest of Europe by the great chain of the Pyrenees. Another range, starting from the Alps, runs southwards down the leg-shaped peninsula of Italy. The mountainous island of Sicily is at its toe. To the east the high land of the Alps runs down to the sea in the mountainous table-land of the Balkan Peninsula, which has many small rocky islands on its shores. Thus the peninsulas of Southern Europe, like those of Southern Asia, are not low but high.

CHAPTER XXVIII.

REGIONS OF PLAINS.

Map Studies : The Great Low Lands of Eurasia.—The high land of Eurasia lies, as we saw, mostly in the southern half of the continent. Therefore the chief plains will be in the north. The whole of Northern Eurasia, except the Scandinavian Peninsula in the extreme west and the Kamchatka Peninsula in the extreme east, is a great continuons plain sloping west or north to the sea.

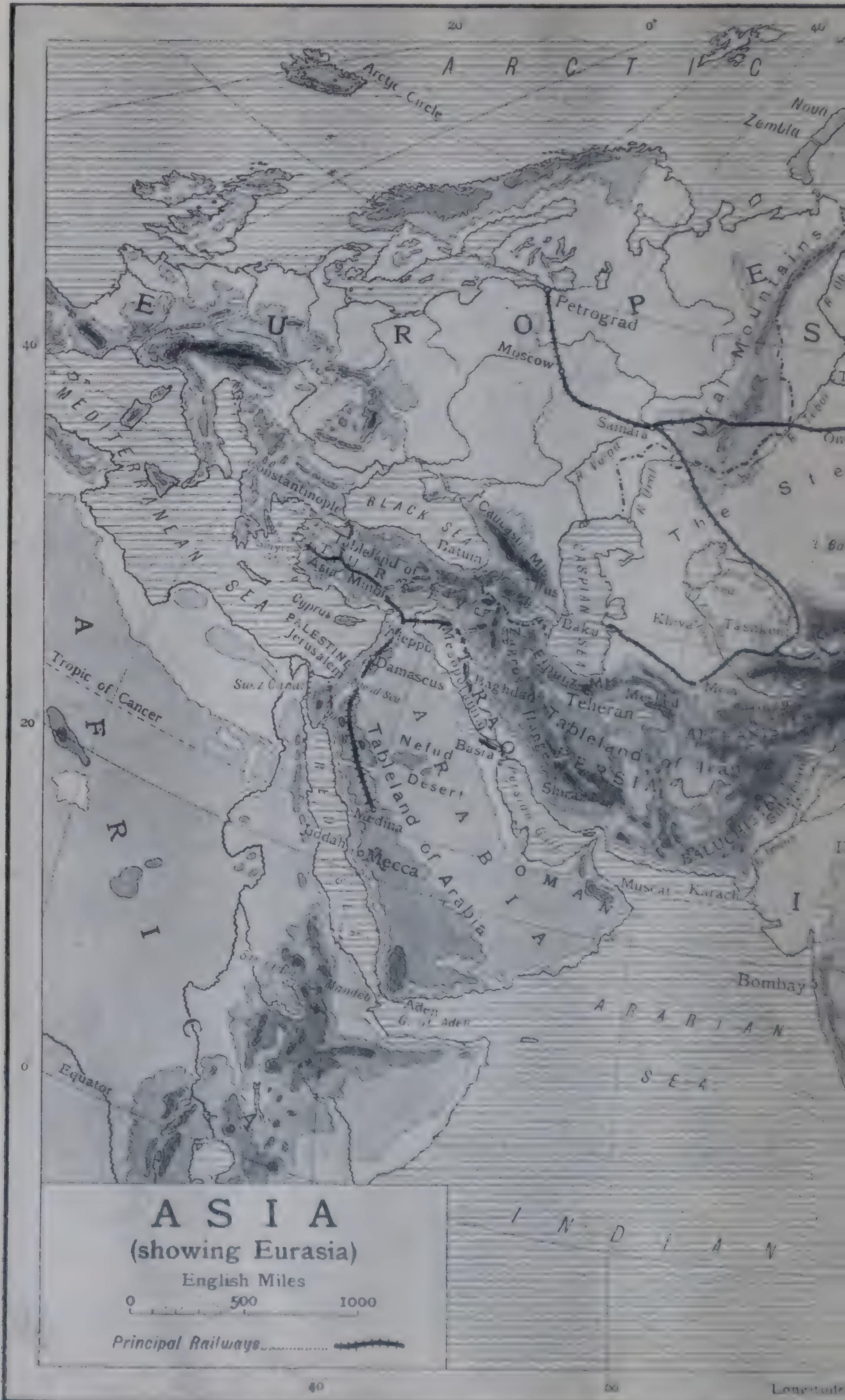
1. The Northern Plains and their Drainage.—The great northern plain of Eurasia starts from the foot of the Pyrenees mountains in the west of Europe. Its slope to the North Sea is narrow. But farther east it broadens out bordering the Baltic and White Seas to the north and the Black and Caspian Seas to the south. The eastern half of Europe is part of this great low land. Beyond the low Ural Mountains it stretches across the north of Asia, getting narrower as we go east. In the west, the flow of the rivers is to the Atlantic. Some drain into the North Sea and some into the Baltic. Farther east, the slope of the plain is northwards into the Arctic Ocean or southwards into the Black and Caspian Seas.

The chief rivers are the Garonne, Loire, Seine, Rhine, Elbe, Vistula and Volga in Europe, and the Ob, Yenesei and Lena in Asia. Of the European rivers the first three are in France, the next two are almost entirely in Germany, the Vistula in Poland and the Volga in Russia. They are much used by boats and small steamers and their valleys are very fertile. The Rhine is the most important river in Europe, though not the largest. It flows from the Alps to the North Sea and is

used by fairly large steamers for more than half its length. Many rivers flow over the Russian part of the Great Plain of Europe. Those entering the cold Arctic Ocean and White Sea are not important, for they are frozen for many months. The long Volga, which receives many feeders in the plain, enters the Caspian. It also is an important waterway. Trace and name the three rivers which flow into the Sea of Azov or the Black Sea. Their names begin with the letter D. These rivers, as they flow through flat plains, are navigable for long distances but, as they are far from the ocean, they are frozen for some months in winter. The Danube, a large and important river, flows into the west coast of the Black Sea. It is fed by many tributaries coming from the Alps and the Carpathians and flows through the fertile plain of Hungary.

The Ob, Yenesei and Lena rise in the high land of Asia and flow over the Siberian part of the northern plain into the Arctic Ocean. Owing to the flatness of this plain, they flow slowly and their feeders branch out widely, so that it is possible to travel by boat east and west as well as north and south. The Ob with its feeders is the chief waterway of Western Siberia. The Yenesei flows almost straight northwards. One of its feeders comes from the deep Lake Baikal, the largest fresh-water lake in Asia. These three rivers are long and in the summer season are much used by boats and small steamers. But they are not nearly so important or so useful as they look on the map. Firstly, they are frozen hard during the winter. When the warm season begins, their upper courses, being farther south, are melted first. The result is that their lower courses are flooded and as the water cannot escape through the hard frozen ground, the country is for weeks turned into a marsh. Secondly, these rivers all flow into the Arctic Ocean which is full of ice for most of the year and which cannot, therefore, be used by ships. Thus these rivers are not gateways of foreign trade like the Ganges or the Irrawaddy. Do you see many seaports marked along the Arctic coast? No. Why not?

2. The Southern Plains.—The position of the high land of Eurasia tells us that the plains on the south must be


ASIA
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English Miles
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Principal Railways
ARCTIC
Arctic Circle
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Petrograd
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Samara
Ural Mountains
The Steppes
Constantinople
BLACK SEA
Batum
Caucasus Mts.
CASPIAN SEA
Baku
Tableland of Asia Minor
Cyprus
PALESTINE
Jerusalem
Aleppo
Damascus
Mesopotamia
Baghdad
Teheran
Tableland of Iran
PERSIA
AFGHANISTAN
BALUCHISTAN
Basra
Persian Gulf
Nefud Desert
Tableland of Arabia
ARABIA
OMAN
Muscat
Karachi
Medina
Mecca
Jiddah
Aden
Bombay
MEDITERRANEAN SEA
Suez Canal
Tropic of Cancer
AFRICA
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Bering Strait
O C E A N
B E R I A
Kamchatka
SEA OF OKHOTSK
Krasnoiarsk
L. Baikal
R. Lena
M A N C H U R I A
Harbin
Vladivostok
SEA OF JAPAN
Tokio
Yokohama
Osaka
J A P A N
Kiu-Shiu
P A C I F I C O C E A N
O L I A
Desert of Gobi
Pekin
Dairen
Port Arthur
Seoul
Fusan
Yellow Sea
Nagasaki
Shanghai
Nankin
Hankau
Formosa
Canton
Hong Kong
Yunnan
D I A
Calcutta
FRENCH INDO-CHINA
Philippine Islands
Manila
S I A M
Bangkok
BAY OF BENGAL
Madras
Saigon
G. of Siam
Ceylon
MALAY STATES
Singapore
Celebes
New Guinea
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much smaller than the great plain in the north. The part of Eurasia south of the high land is largely made up of peninsulas. These peninsulas are either table-lands like Iberia, the Balkan Peninsula, Arabia, and the Deccan of India, or mountainous, like Italy and the Malay Peninsula. The low land of Southern Eurasia will, therefore, be broken up into narrow plains between the peninsulas or along the coasts. The map shows this is so.

In Southern Europe there are two main valleys sloping to the sea. The River Rhone flows from the western side of the Alps southwards down a narrow valley into the Mediterranean. It is of little use for navigation, but its valley is the chief route for traffic by road and rail from the Mediterranean to the interior of France. The Po flows along the base of the Southern Alps across a fertile plain eastwards into an arm of the Mediterranean, just as the Ganges flows eastwards from the Himalayas into the Bay of Bengal.

In Asia, the valley of Mesopotamia, formed by the Euphrates and Tigris rivers, stretches down to the Persian Gulf. Mesopotamia means Doab. In India we have the great Indo-Gangetic Plain stretching across the north and watered by large and small rivers flowing from the Himalayas. On the other side of the Bay of Bengal the narrow but fertile valley of the Irrawaddy comes down to the sea. The Salween, its sister, though a longer river, is not nearly so important because of its rocky course and narrow valley.

3. On the East.—On the east, or Pacific, coast of Eurasia the low lands are broken up by peninsulas, just as they are on the south coast. The rivers take their rise in the eastern flanks of the great high land and flow into the Pacific. The chief of these rivers, counting from the north, are the Amur, the Hoang-ho, the Yangtse-kiang, the Si-kiang, and the Mekong and Menam. The Amur rises in the Yablonoi Mountains. In its upper part it flows through barren hilly country, but there is fertile land near its mouth. The Amur is twice as long as the Ganges and is much used for navigation, but, as it is so far north, it is frozen over for half the year, so

it is not nearly so useful. Besides it flows into a very cold harbourless sea.

The Hwang-ho, or Yellow River, and the Yangtse-Kiang are much the most important rivers entering this coast of Asia. They both flow across China. The Hwang-ho makes a great bend over the Mongolian table-land. Leaving the high land it flows across the broad Plain of China into the Pechili Gulf. This plain is covered very deep with a kind of yellow earth which makes it one of the most fertile areas of the world—even more fertile than the Ganges plain. The yellow soil has given the river its name. The mud and silt brought down by the river have in many places raised its bed above the level of the land, just as sometimes happens with the Ganges. In flood-time the great river sometimes bursts its banks. Then the country for miles round is inundated and the river changes its course. These floods cause great loss of life and property on the thickly peopled plains. In 1852 a great flood took place. A thousand villages were destroyed and thousands of people drowned. Owing to its destructive floods the Hwang-ho has been well called "China's sorrow."

The Yangtse-kiang is the principal river of the country and one of the most important in the world. It rises among the unknown parts of the table-land of Tibet and flows eastwards, dividing China into two nearly equal parts. As a good map shows, the river forms valleys through hilly country for nearly half its course. Then it reaches the fertile Great Plain of China. Here there is a dense population and there are many towns. Ships and steamers can go up the river for hundreds of miles. The Si-kiang, flowing east through the south of China, is not nearly so large nor so important as the other two Chinese rivers, and it does not flow through such a fertile country. The Chinese make more use of their rivers than any other people.

The Mekong rises in the east of the table-land of Tibet, and flows into the sea at the south-eastern corner of the continent in a large fertile delta. It is, however, like the Salween, almost impossible to navigate, owing to rapids. The Menam, a

smaller river, flows southwards into the Gulf of Siam through a large fertile delta.

A good map shows that from the eastern side of the Tibetan table-land parallel ridges run southwards. From this table-land and between these ridges several well-known rivers flow. Notice how the Yangtse-kiang, the Mekong, the Salween and the Irrawaddy, all rise in the same region. We may call them the four sisters. After flowing side by side for some distance they separate and reach the sea in mouths far distant from one another.

THE INLAND DRAINAGE OF EURASIA.

Map Studies: Rivers which do not reach the Ocean.—The Volga (in Europe) and the Ural flow into the Caspian. The Amu-Daria and the Syr-Daria drain into the Aral Sea. In the western table-land region a good map shows the Helmand draining the table-land of Iran into a lake or swamp, and the Jordan flowing southwards into the Dead Sea. The Tarim flows from the Pamirs eastwards through a desert to a marshy lake called Lob-Nor. The water of these seas and lakes is salt. The water of the Dead Sea is so salt that a man cannot sink in it (see map on p. 385).

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CHAPTER XXIX.

THE INDIAN EMPIRE.*

THE Indian Empire is made up of India proper and Burma, and includes the island groups of the Andamans and Nicobars in the Bay of Bengal and the coral islands of the Laccadives in the Arabian Sea. In India a few small areas belong to France and Portugal, such as Pondicherry and Goa.

Boundaries.—The natural boundaries of India and Burma are easily traced on the map. On their land side, these countries are separated from the rest of Asia by ranges of mountains which are difficult to cross. On the sea side, their coasts are washed by the two great arms of the Indian Ocean.

In the north, India is fenced off from the lofty tableland of Tibet by the Himalayas, the highest mountains in the world. They consist of a great mass of high land, stretching in a sword-like curve across the north of India. From end to end they are about 1500 miles long, and in breadth from 150 to 250 miles. To cross this great barrier three ranges must be climbed: first, the lowest and outmost range which, in the eastern half, forms the southern boundary of Nepal and Bhutan. In the west the Siwaliks are separate parts of this outward range. Next come, one behind the other, the two lofty main ranges containing the great snow-covered peaks. They lie in the embrace of two great rivers. In the north-east corner of the frontier of India the Brahmaputra, which

* For a more detailed account teachers and pupils are referred to the author's "A New Geography of the Indian Empire and Ceylon" and a "Junior Geography of India, Burma and Ceylon," prepared for the use of schools in these countries and published by T. Nelson & Sons.

has flowed eastwards for hundreds of miles behind the great mountain barrier, breaks through it and turns south-westwards into the plains. In the north-west corner the Indus, which has flowed for 600 miles north-westwards behind the Himalayas, pierces the mountain barrier and, bending round the high mass of Nanga Parbat, in Kashmir, turns southwards to the plains of the Punjab.

(i) **The political boundary of India in the North** in some places crosses into the mountains; in other places it does not. Thus, in the eastern half it reaches only to the foot of the mountains. Here (except for a short distance into the mountains round Darjeeling) Nepal and Bhutan occupy the Himalayas and their valleys. In the western half the political boundary goes far into the mountains. As the map shows, some of the highest peaks of the Himalayas, among which the Jumna and Ganges are born, lie within the United Provinces. Still farther west, in the Punjab Province, the political boundary goes far beyond the natural boundary. There the native state of Kashmir stretches back right across the two main Himalayan ranges, over the Indus and Gilgit rivers, beyond the great Karakoram range, and touches the distant Kuen Lun and Hindu Kush ranges. Kashmir is thus filled with a mass of snow-covered mountains, with many narrow river-valleys and one broad one—the Vale of Kashmir, through which flows the Jhelam.

(ii) **The North-West Frontier.**—Just as India is fenced off from the table-land of Tibet by the lofty Himalayas in the north, so it is separated by lower ranges from the hilly tableland of Iran (Afghanistan and Baluchistan) in the north-west. The map shows these ranges stretch in a long line, nearly parallel to the Indus, from Peshawar to Cape Monze, near Karachi. This mountain barrier is made up of the Safed Koh, the Sulaiman Range, and the long parallel ranges of the Khirthar Mountains. We may call this mountain barrier the western offshoot of the Himalayas, stretching from the sea right up to the Hindu Kush Mountains in the north of Kashmir. The natural boundary of India lies only " as far as the grass will

grow " to the east of this barrier but, for the sake of protecting India, the Government has arranged that the political boundary shall go beyond the mountain edge, so that the passes over it may be guarded. Thus the North-West Frontier Province stretches into the mountains, as the map shows, for about 100 miles west of the Indus. Farther south, Baluchistan stretches far across the barrier into the mountainous table-land to the west. Most of it is a native state belonging to the Khan of Kalat, but the part round Quetta is under the Government of India.

Passes.—1. We have now traced the natural and political boundaries of India in the north and the north-west. At places on these long boundaries are passes leading from the plains of India. Those **across the Himalayas** are not important except as gateways of trade. No army could ever cross by them to invade India. One route leads from Darjeeling by passes and valleys across the Himalayas and then over the Brahmaputra, here called the Tsangpo, to Lhasa, the capital of Tibet. From Simla another route goes by the Sutlej gorges and the Shipki pass to Tibet. Another route leads from Leh, a hill town far up the Indus in Kashmir, by high passes across the Karakorams to Yarkand, far off in Chinese Turkestan. These routes are very difficult and very steep in many places: the bridges by which they cross rivers are small, and for many months the passes on them are blocked by snow.

2. **It is different in the North-West**. Here the mountains are lower and the passes easier. Many of the routes here follow the course of rivers flowing from the table-land of Iran into the Indus. Thus, the valley of the Kabul river, which flows east from Kabul, the capital of Afghanistan, is a natural gateway from the plains of India. But the route does not follow this valley all the way. From Peshawar it goes by the Khyber Pass, a winding, narrow and rocky defile about 20 miles long, till it reaches the valley of the river. This is the most important pass in the world. During 2000 years it has been the gateway through which warrior chiefs and armies have come to conquer the rich plains of India. A railway has now been built

with great difficulty up this pass from Peshawar. A good map shows the Kuram, Tochi, Gomal and Bolan Passes. The last is the most important. A railway has been built joining Jacobabad

FIG. 66.—The Khyber Pass and Kabul River.

through this pass with Quetta, and this line is continued beyond to the frontier of Afghanistan, overlooking the valley in which Kandahar lies.

(iii) **The North-Eastern Frontier.**—Turning next to the north-east, we see from the map long ranges running nearly north and south with long valleys between them. These mountains and valleys make up the country of Burma. From the eastern end of the Himalayas a long range runs southwards in a curve till it ends in Cape Negrais. The northern half of this mass of mountains separates Burma from Assam. Here it is broad and sends spurs westwards into Assam, so that that country is very hilly. Farther south the ranges are called the Lushai and Chin Hills, partly in India and partly in Burma. After they narrow into a long single range, these mountains are called the Arakan Yomas. Other ranges farther inland also run south and continue right down to the Malay Peninsula. These are the Tenasserim Yomas. Between these two main ranges is a smaller, shorter and lower range called the Pegu Yomas. We see from the map that Burma, the part of the Indian Empire which lies next to China and Siam on the east, is a country of mountains and valleys running nearly north and

south. The two main rivers are the Irrawaddy and Salween. Hence it is very difficult to pass from east to west across Burma. To do so we must climb parallel ranges of jungle-covered mountains and cross two large rivers over which there are no bridges. Burma is shut off from the rest of Asia by mountains, and there are very few and difficult paths across them. It would be very difficult for an army to enter Burma from the east across the mountains. No railways join it with India or with other countries. One trade route runs by valleys and passes from Bhamo, far up the Irrawaddy, eastwards into China. The easiest way to visit Burma is to sail up the Irrawaddy from Rangoon, or to travel by the railways which have been built up its valleys.

We thus see that the Indian Empire is splendidly protected all along its land boundaries by mountains difficult to cross. The only real gateways across these mountains into India are in the north-west, leading from Afghanistan and Baluchistan. On this part only of the frontier have forts been built to guard the passes.

Mountain Dwellers.—On these barrier mountains of India and Burma and in their valleys only a small part of the population live. There is not enough space in the valleys to grow crops to feed many people. On the slopes of the hills they are mostly shepherds and forest dwellers. We have already learned about the life of people among mountains. They are rude and uneducated, but hardy and brave. In the hilly border lands west of the Indus live many warlike tribes, who have often invaded India. The sturdy Gurkhas of the mountains of Nepal are also hardy cultivators, shepherds and soldiers.

(iv) **The Coasts.**—The real gates of India and Burma to-day are sea-gates. A single large steamer, sailing from or to Bombay, Madras or Calcutta, carries as many goods as come across any of the mountain passes in a year. The map shows that the coasts of India are broken by few inlets of the sea or islands. There are thus few places where large and deep sheltered harbours can be built. Again, the sea all round the coast is very shallow, so that the Ranns and Gulf of Cutch, the

Gulf of Cambay, the Palk Strait and Gulf of Manaar (between India and Ceylon) are of no use for harbours for large vessels. On the map the Pulicat and Chilka Lakes on the east coast look important, but they are far too shallow to float ships or steamers. The river-mouths are mostly blocked with sand, so that no ocean steamers can sail up them. There are only two exceptions—Calcutta, on the Hughli, and Rangoon, on a branch of the Irrawaddy. Here, owing to high tides, large vessels can use their harbours, but the beds of these rivers must be constantly dredged to keep them deep enough for ocean-going steamers. Bombay, Calcutta, Karachi, Madras and Rangoon are the only large deep-water harbours of India. Along the shallow coast are seaports off which vessels have to anchor and load and unload their cargoes by the help of boats from the shore. All along the coasts, too, there are fishing villages where the people reap the harvests of the sea.

We can divide the land of India lying between its mountainous land frontier and its sea frontier into different regions.

1. **The Great Indo-Gangetic Plain.**—This stretches right across the north of India and touches the Himalayas in the north and their western and eastern offshoots. South of it lies the Deccan table-land. For thousands of years rivers flowing from these highlands on all sides have been carrying down mud and silt to form this great plain. The western part is made up of the flat valleys of the Indus and its feeders, and touches the Arabian Sea in the Indus delta and the flat coasts of the Ranns and Gulf of Cutch. The eastern and larger part includes the lands watered by the Ganges and Jumna and their many feeders and by the Brahmaputra and its feeders. It reaches the head of the Bay of Bengal in the huge flat delta formed by the Ganges and Brahmaputra. A good physical map shows the watershed dividing the western from the eastern drainage. This great Plain is one of the most important in the world. The whole of it is made up of deep, fertile soil washed down for thousands of years by the great rivers and spread over the plains thus formed. This region is

therefore very flat. Even Agra, half-way between the deltas of the Ganges and the Indus and 1300 miles distant from the sea by river, is only 550 feet above sea-level. This flatness makes the rivers flow slowly, so that their water can easily be used to irrigate the fields, and canals can easily be dug. As they flow slowly, these rivers are very useful for boat and shallow steamer traffic. Owing to the flatness of the Great Plain, roads and railways can easily be made. A railway map shows more lines running over this part of India than over any other. It contains more than one-third of the area of India, most of the large towns and two-thirds of the population.

We must remember, however, that the eastern half of the Plains gets much more rain than the western half. It is therefore more fertile and has many more towns and people. The western half, as it gets much less rain, grows less food and has a much smaller population. Part of it is taken up by the Thar and Sind deserts. Beyond the parts irrigated by the Indus and its feeders and their many canals there is not much cultivation.

2. **The Table-Land Region.**—The great table-land of the Deccan stretches south of the Plains and fills up the whole of the peninsula of India except the coast-strips.

(*a*) **The Table-Land of Central India** is that part of it which lies between the Aravalli and the Vindhya ranges. The map shows it is drained into the Plains by the Chambal and other rivers flowing north-east into the Jumna, and by the Son, which enters the Ganges near Patna. This part is called the Malwa plateau.

(*b*) **The Deccan Table-Land** is much the larger part. In shape it is a triangle with its apex facing south. We can see it is higher in the west than in the east, for all the rivers, except the Narbada and the Tapti, drain into the Bay of Bengal. Of these the Mahanadi, Godavari, Kistna and Kaveri are the largest. Its western edge is formed by the long ranges of the Western Ghats, which run almost without a break from the Gulf of Cambay to Cape Comorin. Its eastern edge is formed by the Eastern Ghats. These are not a single range,

but are made up of different ranges called by different names in different places. Between these ranges the rivers flow in valleys to the Bay. The Eastern and Western Ghats may be said to meet in the Nilgiri Hills, the highest peak of which is Dodabetta (8640 feet), and just north of this lies the highest part of the table-land (Mysore), across which the Kaveri flows.

In the north, the Deccan table-land is crossed by different ranges of hills running roughly in a south-west to north-east direction as far as the Rajmahal Hills, which overlook the Ganges not far from the head of its delta. A good map shows the Vindhya and Satpura ranges on either side of the Narbada, the Mahadeo, the Maikal and other ranges, and the Chota Nagpur and Orissa highlands, which continue them up to the north-east corner overlooking the Ganges Plain and Delta.

Unlike the plains, this great table-land is not alluvial. It has been raised up by volcanic forces and earth-movements. It is, therefore, built up of hard rocks covered with thin soil, except in the valleys worn out by the rivers during long ages, where they have washed down mud and spread it during floods over their banks. Nor is this table-land flat like the plains. Here we are never out of sight of hills and ridges. Ranges of low mountains cross it. Thus the table-land is not nearly so fertile as the plains. There is not so much room for cultivation. Fewer food crops can be grown, and there are fewer villages and towns, and the population is not nearly so dense. For the same reason, it is more difficult to make roads and railways over the rocky, uneven ground. As the rivers are not snow-fed like those born in the Himalayas, and as the rain falls only during the monsoon months, the rivers, all except the largest, dry up in the hot season. Many of them then become mere trickles or strings of stagnant pools. They flow over rocky beds. For these reasons they are of but little use for navigation, even for boats. Even the largest of them, the Godavari, becomes very shallow. For the same reason canals are difficult to dig. The level of the land is uneven and there is not enough water in the rivers to feed canals. This

makes irrigation also difficult. Fields must be watered by deep wells, or from tanks in hollows where the water of the monsoon season can be stored.

3. **Region of Coast Strips.**—(*a*) From the head of the Gulf of Cambay right down the west coast a narrow, low-lying strip stretches between the Western Ghats and the seashore. As this strip receives the full force of the monsoon rains dashed against the mountains behind it, it is crossed by several short rivers, and is a damp and fertile rice-growing country. Its northern part is the Konkan, and its southern the Malabar coast. In the latter the rivers form many back-waters along the coast, on which hundreds of boats and rafts carry goods. There is only one easy pass—the Palghat Gap—leading across the Western Ghats from the Arabian Sea coast.

(*b*) From the delta of the Ganges right down to Cape Comorin there is a similar low-lying strip, stretching inland to the foot of the Ghats. The map shows this strip is much wider than that on the west coast. It is much broader in its southern half, called the Coromandel coast, where it extends back right to Western Ghats. Unlike the west coast strip, it has several large rivers flowing across it, bringing with them nearly all the drainage of the table-land. The most fertile parts are the flat rice-growing deltas of the Mahanadi, Godavari, Kistna and Kaveri, but the lower valleys of the smaller rivers are also very productive. From this coast-strip the table-land can be reached much more easily than from the west coast, because the valleys of the rivers can be used for roads and railways and the Ghats are much less steep. Along this east coast strip railways have been made; the land is level and not rocky. Starting from Madras we can travel northwards along it all the way to Calcutta or southwards to Pamban Island, where a ferry steamer takes us across to Ceylon. The chief difficulty was the bridging of the rivers. The railway bridges across the Godavari and Kistna are among the largest in India.

THE SOILS OF INDIA.

Just as in other countries, so, in India, the soils are the most important part of the earth's surface. The map (Fig. 67) tells

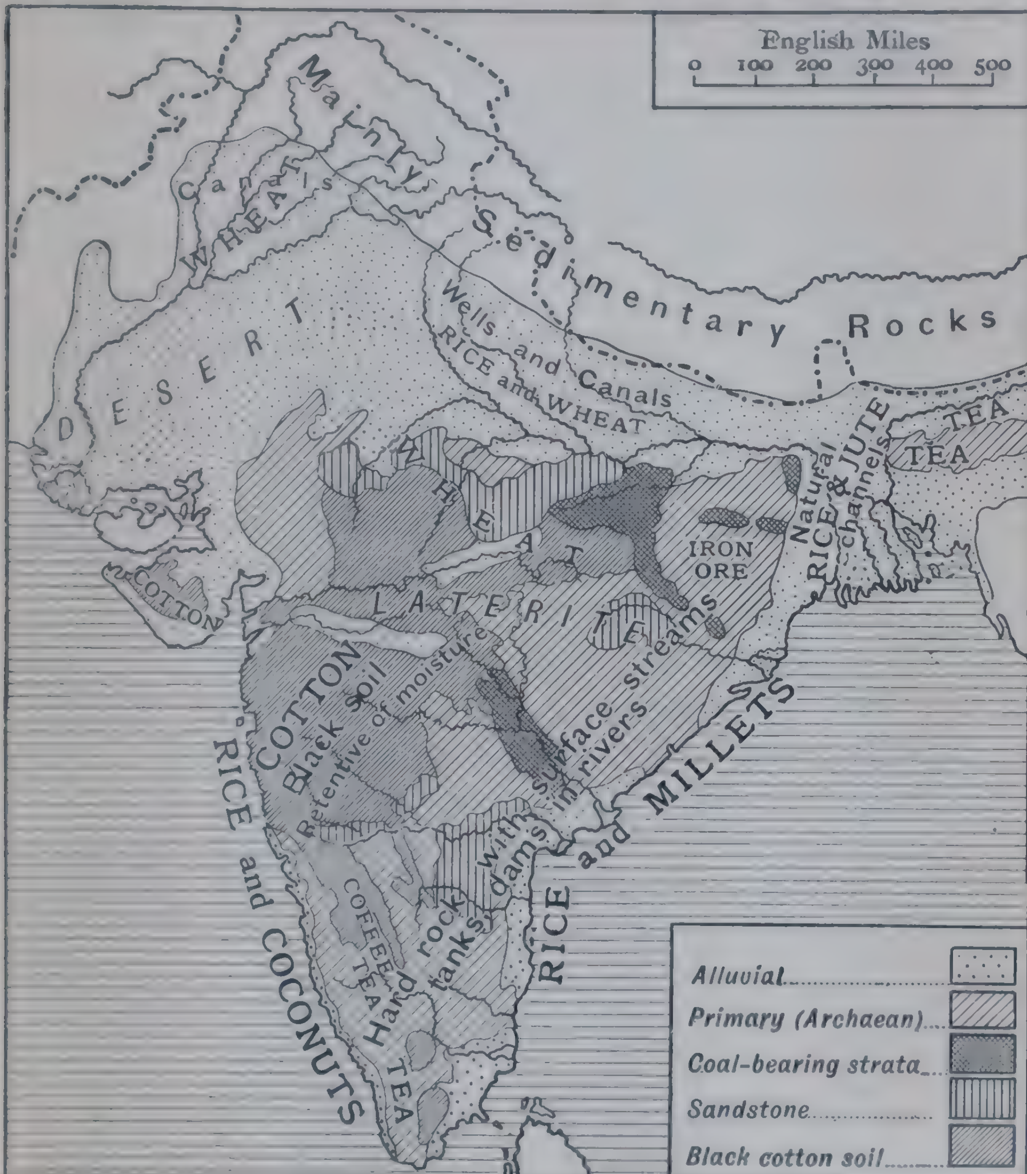


FIG. 67.—Rocks, soils and crops of India.

us something about Indian soils and the rocks underneath. As we have learned, soil is made by the wearing down of rocks in two ways. **Residual soil** is composed of the particles of underlying rocks mixed with some organic matter, such as the decaying remains of plants and animals. The soil of the

peninsula of India is mainly residual. It is made up of the primary rocks lying beneath, which the rains of the monsoon and the hot sun have soaked and scorched for thousands of years. The archaean rocks have been slowly weathered into a yellow or sandy soil. It is usually shallow, because these rocks are very hard, and it is not very fertile. Laterite, which covers large parts of India from the Plains to Cape Comorin, is another soil formed in this way. The black cotton-soil (regur) of the Deccan has been decomposed from the lava and volcanic rocks of this part of India. Unlike laterite, it is a fine dark loam containing plenty of plant-food, and can retain moisture for a long time. This makes it very fertile. Rajputana (part of which is desert), where no rivers flow and but little rain falls, has very little soil, and here, therefore, few crops can be grown. The soil of the valleys of the Peninsular rivers is good, because here the monsoon rains have washed down the decomposed rock-particles and gathered them into hollows where they lie deep, forming rich beds of clay.

The other kind of soil is called **alluvial** or **drift soil**. It has been formed by rivers which have swept down and mixed particles of sand, clay, lime and decaying parts of plants. This kind of soil, as the map shows, covers the great plains of the Indus, Ganges and Brahmaputra, and the broad basins and deltas of the rivers of the peninsula. It also fills the valley and delta of the Irrawaddy. It is usually a light-coloured loam, well mixed and therefore easy to plough. The alluvial soils of India and Burma yield the richest crops.

CHAPTER XXX.

THE RIVERS OF INDIA AND THEIR USEFULNESS.

EVERY Indian student should know the course of the chief rivers. Without them, India would be a much less fertile and much less densely peopled land. In no part of the world are rivers so useful; perhaps that is why so many of them are sacred, with temples on their banks. We must, however, distinguish between those that are fed by the melting snow and ice of the Himalayas and those fed by rain only. During our cold season much of the moisture on these lofty mountains is changed into snow, and many of the springs in the high valleys are sealed by frost. This moisture is, therefore, stored up for months. When the warm season begins again, it is released and the large rivers and their feeders are swollen by the melting of the snow. This water they carry down to the plains and it can be used in irrigation at a time when little or no rain falls. With the other rivers it is different. They are swollen during the monsoon but, when that is over, they gradually become smaller, so that, during our cold season and till the next monsoon comes, they run very low. Even large rivers, such as the Narbada, the Godavari and Kistna, have then very little water, and many of the smaller ones are nearly dry.

Trace the course of the **Indus**. It rises behind the Himalayas in Tibet, nearly 17,000 feet above sea-level, and makes a long journey by deep valleys through those mountains before it reaches the plains. For the first third of its course it flows north-westwards till it bends round the great mountain of Nanga Parbat, in Kashmir, and there turns nearly south. During this mountain part of its course it falls 16,000 feet, so

that here its current is very fast through gorges. Near the bend it is joined by the **Gilgit,** which comes from the snowy Hindu Kush Mountains, and, just where it enters the Punjab province, it receives the **Kabul** from Afghanistan, draining the southern slopes of these mountains. Its journey across the plains extends from the Salt Range to Hyderabad in Sind. Here it is still 500 miles from the sea and only 300 feet above its level, so that it flows slowly through a network of channels over level ground.

On its left bank it receives the **Panjnad**, which brings the united waters of the Five Rivers. By this time it has reached the Sind desert. No more feeders help it and its volume becomes smaller. Below Hyderabad its delta stage begins. The bed of the river being raised above the level of the surrounding country by the silt it carries down, its waters spill over into distributaries, which enter the sea by widely separated mouths. This delta is too dry to be cultivated and, owing to the shallowness of the sea, the river is quite useless for navigation by large vessels. The Indus delta is quite different from that of the Ganges, which is a network of waterways used by hundreds of flat-bottomed steamers and boats. Its right bank feeders drain valleys which form routes across the frontier mountains. The Kabul, Kurram and Gomal are the most important. The left bank feeders are longer, fuller and much more useful. They flow out of Himalayan valleys, where their courses are rapid, into a flat plain, where they become slower and are much used for irrigation.

The Sutlej rises in the sacred Rakas Tal Lake, close to the source of the Indus, in Tibet, but it has a much shorter journey through gorges across the Himalayas and the Siwaliks. In its plain stage it flows south-westwards towards the Indus. The map shows that its course and that of the Indus form a right-angled triangle. Within this triangle lie the other four left bank tributaries which also come from Himalayan valleys into the plains—**The Jhelam, Chenab, Ravi and Bias.**

The Indus and Sutlej are matched by **the Ganges and**

Brahmaputra which drain more than half of the Himalayas. **The Ganges** rises in the Gangotri glacier and flows through deep mountain valleys till it enters the plains at Hardwar, where its waters are used to feed the great Ganges canal. From Hardwar all the way to Goalundo, where it joins the Brahmaputra, this great river flows through one of the most fertile plains in the world and receives its main tributaries. Into the left bank come the **Ramganga, Gumti, Gogra, Gandak** and **Kosi**, all of which, except the Gumti, are born high up among the Himalayas. Its chief right bank feeder is its sister, **the Jumna**, which also rises in a mountain glacier. But, after reaching the plains, the Jumna brings with it the waters of the **Chambal, Sind and Betwa,** which flow from the Vindhya ranges across the Malwa plateau. **The Son**, which also drains this plateau, joins the Ganges near Patna. The feeders coming from the table-land are much less useful for irrigation than those flowing from the Himalayas, because they are not snow-fed and quickly run dry. **The Brahmaputra,** rising not far from the sources of the Indus and Sutlej, flows eastwards for hundreds of miles behind the Himalayas in Tibet, and then, turning sharply round their eastern end, runs nearly west down the Assam valley till it passes the end of the Garo Hills. Here it turns and flows southwards to its meeting-place with the Ganges.

After the Ganges and Brahmaputra meet, their waters are increased by those of the **Barak** coming from the valleys of Assam. Thus, what we call the Ganges delta is really a triple delta, for the three rivers split up into distributaries. The Ganges delta begins where the **Bhagirathi** breaks off southwards from the main channel before it reaches Goalundo. In its southern half it is known as the **Hughli,** on which Calcutta stands. The great delta formed by these three rivers has a sea-face of 200 miles. It is a network of creeks and estuaries very useful for navigation. In many of them the water is half salt, for the tide rushes up and checks the current of the rivers, which are forced to deposit their burden of silt. The part of the delta near the sea is made up of flat mud islands covered with jungle, known as the Sundarbans.

Most of the Himalayas are outside the frontier of India, but the great rivers bring all the benefits of this great storehouse of water to India. The Indus and Brahmaputra, like two great arms, clasp themselves round the Himalayan ranges so that all the moisture that they catch, whether as rain or snow whether in Tibet or in India, is brought by these rivers and their feeders into the plains of India. It is the same all round the land frontier of India. The rain that falls and the snow that melts on hills outside this frontier are brought by many rivers, large and small, into its plains. From India no river flows out.

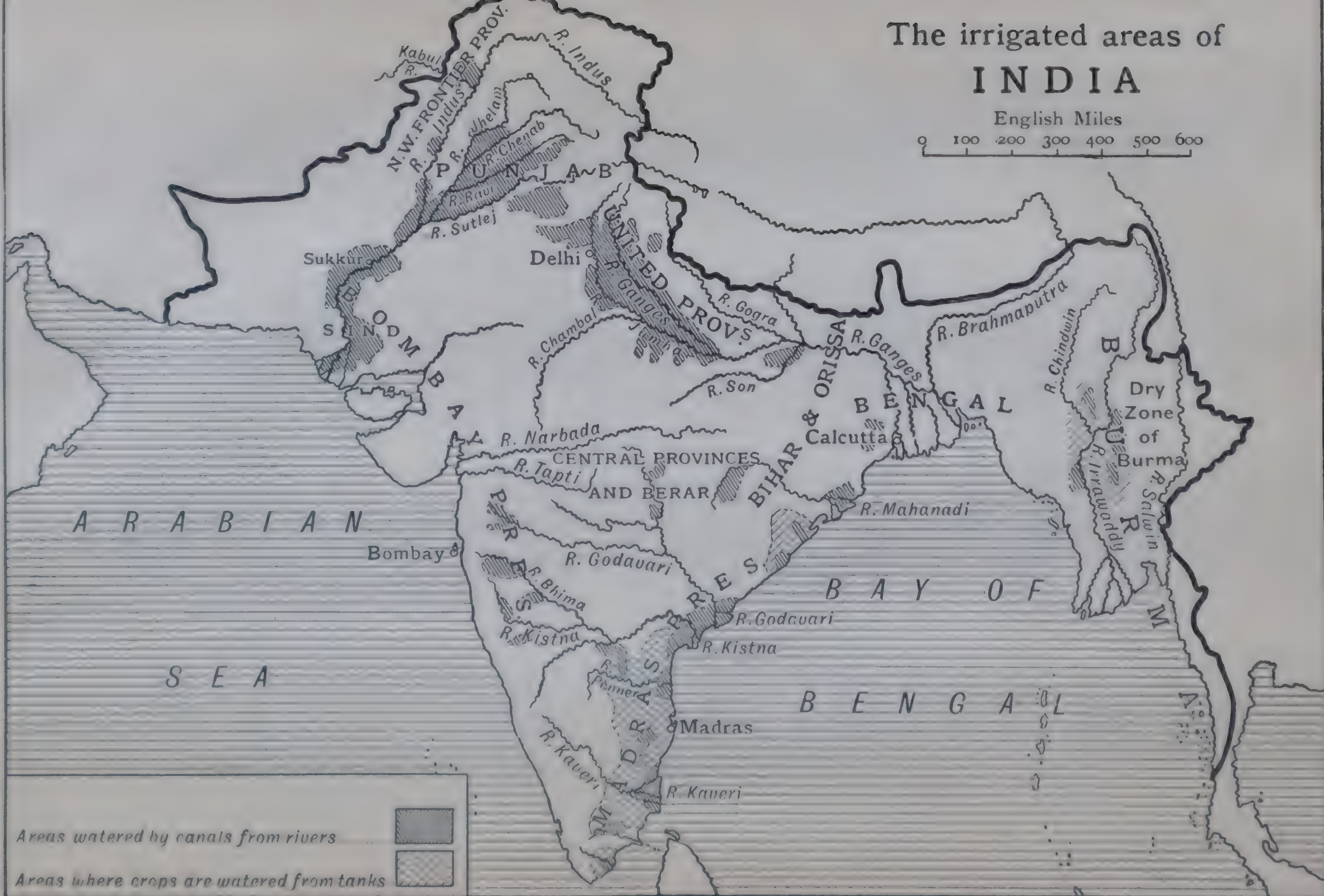
Rivers of the Deccan Table-Land.—We have seen that the **Chambal** and **Son** drain the northern part of this high land into the Jumna and Ganges. Two others, the **Narbada and Tapti**, drain the rainfall of the Vindhya and Satpura Mountains into the Arabian Sea. They have no deltas and so are navigable by small vessels for about 60 miles up from the sea in flood time. The rest of the Deccan table-land is drained into the Bay of Bengal by four large rivers and several small ones. Trace in order the courses of the **Mahanadi, Godavari, Kistna, Penner, Palar, Ponnaiyar, Kaveri and Vaigai.** As these rivers are not snow-fed and flow through parts of India where the rainfall is not very heavy, they are, except in the rains, usually shallow and of little use for navigation. The smaller ones are often dry. The deltas of the large rivers are well irrigated and grow good crops of rice and sugar-cane. They are, therefore, densely peopled.

Rivers of the West Coast Strip.—In the monsoon the rainfall is very heavy, and therefore there are many rivers, but they are short, for their sources in the Ghats are close to the sea. Many of them are joined by back-waters and canals, so that they are much used by boats, canoes and rafts.

CHAPTER XXXI.

IRRIGATION.

Most of the people in India live by agriculture. The climate is hot, and water is needed to fertilise the fields. It is different in countries where the sun is not so strong. There the farmers must dig drains to take the surface water off the land. The important question for India has always been, How can the rain that falls on its hills and plains and the water that flows down its rivers be saved to irrigate the crops? Every year these rivers carry millions of tons of water uselessly into the sea. Can that water be saved and made useful? For hundreds of years people in India have tried to do this by building dams across the rivers, by making irrigation canals, by digging tanks and sinking wells, and in later times the Government of India has greatly helped this work by borrowing the large sums of money needed for such works. But, even so, only a small part of the total rainfall of India can be used in irrigation. Hold out your arm and stretch your fingers. Let this stand for the total rainfall of India. More than half—from your shoulder to your elbow—is sucked up by the soil or evaporated by the sun's heat. Nearly all the rest—from your elbow to the palm of your hand—is carried to sea by rivers large and small. Only the small part that is left—the fingers—is used for irrigation canals. Why is this? If we look at the physical map and remember the rainfall of India, we can understand some of the reasons. In the first place, an enormous volume of water is poured into the sea down the steep seaward face of the Western Ghats during the summer monsoon. It has been reckoned that about one-sixth of the total surface flow of India is lost on this slope alone.



Emery Walker Ltd. sc.

The ryots on the coast strip do not need it, because their fields get plenty of rain without using the rivers. (The same thing happens in Burma. There the rainfall, except in the dry zone, is heavy, and irrigation canals are not needed.) In the second place, this water cannot be made to run uphill to irrigate the dry parts of the Deccan.

But much has been done. Several years ago the Government of Madras built a huge stone dam across the Periyar, a river flowing down the west slope of the Western Ghats in Travancore state. They then cut a long tunnel through these hills, and led the water along it from the dam to run down the eastern slope, irrigate thousands of acres and then flow into the Vaigai which enters Palk Strait. Water, which before ran useless into the Arabian Sea, is thus led across the peninsula into the Bay of Bengal, irrigating the drier lands on the eastern side. Every one has heard of the Tata hydro-electric works. Great stone dams have been built in the Western Ghats behind Bombay city to catch and store the heavy rain of the monsoon. The water stored in these dams is led in huge iron pipes to the seaward edge of the Ghats. Here it rushes down more pipes from a great height with great force. This force turns turbines which generate electricity. This electricity is taken by wires to Bombay to drive cotton mills and light all the lamps of the city. The water itself, after doing this work in the machines, is taken into Bombay partly as drinking water and partly to irrigate gardens. By this scheme an immense volume of water, equal to a river, which before ran useless to the sea, is made to do a great deal of useful work. More dams for the same kind of work are being planned. Another great dam is being built about thirty miles from Poona. The water stored by this dam during the monsoon months will form a lake nearly fifty miles in circumference, and this enormous supply will be available for irrigation from October to May when there is practically no rainfall. It is part of one of the greatest irrigation schemes ever undertaken. Another huge dam has been built across the Kaveri in Mysore state. When it is finished, the stored water will cover an area

of forty square miles. In the lower Ganges valley and in that of the Brahmaputra irrigation works are not needed, because plenty of rain falls there. But no engineer could ever harness these mighty rivers. Their floods would sweep away any dam, however strong, in a few hours. Above Benares, where the Ganges is smaller and less rain falls, there are, indeed, large canals irrigating an immense area but even these great works save only a fraction of the river water. Almost the whole of it flows away and is lost. In the same way, although there are great dams across the Mahanadi, Godavari, Kistna and Kaveri at the necks of their deltas, they can save only a small part of the flood waters of these rivers.

The Punjab is the province where irrigation on the largest scale has been carried out. No country in the world has such a splendid system of canals. The irrigation map shows that nearly the whole of the cultivated area of the Punjab depends on canals led from the great rivers. As the rainfall is small, they have no tributaries in the plains. A good map tells us the reasons why this province is so suited to irrigation. (1) The Indus and its Five Rivers are fed by the melting snows and ice and the heavy rainfall of the Himalayas—a storehouse of water which never fails. (2) They spread out over the plains like fingers of an open hand, so that they can be joined by canals. (3) The land is nearly level and the soil soft, so that canals can be cheaply dug. The great difficulty is to keep their channels from silting up. (4) The soil is alluvial and fertile, though thirsty, and, if canals can be led over it, their cost can soon be repaid by large crops. The irrigation works on these Punjab rivers have increased the crops and the population enormously. Land which was formerly half desert is turned into wheat and maize fields round villages of farmers. The Lower Chenab Canal, which has three main branches, is one of the greatest irrigation works in the world. It carries as much water as the Thames, and irrigates more than two million acres. A busy town, Lyallpur, has sprung up here, where formerly there was nothing but scrub, and a large agricultural college to train students in the best methods of tillage, selection of seed, etc.,

has been built. In 1923 work was begun on a scheme for building an enormous dam or barrage across the Indus at Sukkur, in Sind. It will cost many lakhs of rupees and take several years to construct, but it will irrigate more than five million acres of land. It is the largest irrigation project in the world.

The Danger of Famine.—From the same map we can learn what parts of India are most in danger of famine and what parts are safe from it. We do not find severe famines in districts where usually little rain falls. There, there are only few people and not much food is needed. Thus, in the dry area less than 10 in. of rain falls,—over large tracts less than 5 in. But here the people do not expect more and do not depend on it. Again, in the doabs of the Indus and the Five Rivers the rainfall is moderate and varies from year to year. But in our days this large region very seldom suffers from famine, because the country is watered by a splendid network of canals. They are led from the rivers which rise in the great storehouse of the Himalayas. So, too, the Upper Ganges districts and the deltas of the large rivers on the east coast are protected by irrigation works on these rivers. The ryots on the Kistna delta stand knee-deep in their rice fields though no rain has fallen for weeks. This water comes from rain which has fallen on the distant Western Ghats and is stored up by dams built across the river. On the west coast strip, in the Lower Ganges Valley, the Assam Valley and in Burma, where the rainfall is always heavy, it does not much matter if there is a shortage of 20 or 30 inches, because there is still plenty of rain to fertilise the fields. It is in the table-land of the Deccan that famine is most to be feared. Here (except in the east Satpura area) the rainfall is usually only about 30 inches, and there are few irrigation works. In India, with its hot and thirsty sun, it is difficult to grow even dry crops with less than 30 inches of rainfall. If, therefore, there is here a shortage of 10 or 20 inches, crops cannot grow, the cattle are starved and there is little food to eat.

In the history of India we read of great famines, when the


INDIA
Density of Population
by Natural Divisions
with Rainfall
English Miles
0 100 200 300 400 500 600
Reference
The figures (8·7) show the Normal Rainfall of each Division.
0-100 per square mile
100-200 " "
200-300 " "
300-400 " "
400 and above " "
AFGHANISTAN
TIBET
NEPAL
BHUTAN
CHINA
SIAM
BALUCHISTAN
NORTH WEST DRY AREA
HIMALAYA AND SUB HIMALAYA WEST
INDO GANGETIC PLAIN WEST
HIMALAYA & SUB HIMALAYA EAST
INDO GANGETIC PLAIN EAST
BRAHMAPUTRA VALLEY
DELTA OF BENGAL
BURMA
BURMA DRY
BURMA COAST
CENTRAL INDIA PLATEAU
GUJARAT
EAST SATPURAS
WEST SATPURAS
DECCAN
EAST COAST NORTH
EAST COAST MADRAS
SOUTH INDIA
WEST COAST
ARABIAN SEA
BAY OF BENGAL
Laccadive Is.
Andaman Is.
CEYLON
8·7
11·4
50·4
30·9
47·5
71·9
92·3
64·3
79·4
32·6
152·9
34·6
27·6
57·7
51·5
29·7
48·0
104·3
33·2
Kabul
Peshawar
Srinagar
Lahore
Simla
Naini Tal
Delhi
Quetta
Kalat
Bela
Karachi
Jodhpur
Ajmer
Agra
Gwalior
Jhansi
Udaipur
Lucknow
Allahabad
Darjeeling
Cooch Behar
Shillong
Manipur
Lashio
Mandalay
Taunggyi
Prome
Rangoon
Chittagong
Calcutta
Cuttack
Puri
Indore
Baroda
Rajkot
Bhuj
Diu (Port.)
Daman (Port.)
Bombay
Amraoti
Nagpur
Hyderabad
Goa (Port.)
Mahé (Fr.)
Mysore
Trichinopoly
Pondicherry (Fr.)
Karikal (Fr.)
Cochin
Tuticorin
70°
80°
90°
100°
30°
20°
10°
Longitude East 90° of Greenwich
Emery Walker Ltd. sc.

monsoon rains failed, the cattle died, and lakhs of people perished for want of food. In our own days when the monsoon rains fail in some parts of India, the crops wither, but very few people need die of starvation. One reason is that railways have now been built and the Government can quickly send food to the starving, and seed for next season's sowing. Besides, they now know much more about the climate of India and can more easily foretell if, and when and where there is likely to be a shortage of rain. Government is now prepared to meet famine.

The Distribution of Population.—By studying the physical map of India, its rainfall and its irrigation we can understand how the population is distributed. The two main points to remember are : (1) the population is very large (320 millions in 1921) ; (2) most of the people live by cultivating the soil. Hence the population will be most dense where the soil is most fertile, and the soil is most fertile in plains easy to plough, where there is a good and regular rainfall, or where there are many irrigation canals, tanks and wells. In districts which are mountainous or covered with forest, or unhealthy, or open to the attacks of enemies, there, even though good rain falls, the population is sure to be scanty.

The map on p. 272 shows India and Burma divided up into different regions. The shading shows the density of population of these regions, *e.g.* it is less than 100 persons per square mile in Baluchistan and more than 400 per square mile in Bengal. The figures marked on this map give the yearly average amount of rainfall for each region. The delta of Bengal has a heavy rainfall (70 inches) and a dense population. So has the Himalaya and Sub-Himalaya-East region. Though the Indo-Gangetic Plain, East and West, receives less rain, yet there are here splendid irrigation works on the Ganges, Jumna and the Five Rivers, and the soil is alluvial, so that the population is dense. The Brahmaputra Valley region, though it gets more rain, is less thickly populated. Why ? Because (1) it contains many mountains and jungles ; (2) the lower hills are unhealthy ; (3) a hundred years ago it was overrun by the Burmese who left it almost without inhabitants.

Next come the coast strips. The west coast has a heavy rainfall of 104 inches, and its rice-fields can feed a dense population. It is full of villages. The east coast, from the Ganges to the Vaigai, gets less than half the rainfall of the west coast, yet in the south it is fairly dense, because here there are few mountains and the rivers and tanks irrigate large areas. The most thickly peopled part is the Kaveri delta. The north part of this coast is less thickly peopled, though it gets more rain, because here the coast strip is narrow and the region includes the forest-covered ranges of the Eastern Ghats.

The table-land of the Deccan and the Central Indian plateau are more thinly populated. Except in the valleys, the soil is not alluvial, much of the land is hilly, there are almost no irrigation canals and the rainfall is well under 40 inches. The East Satpura region of the Deccan gets more rain (57·7 inches), but large parts of it are hilly and covered with jungle.

The dry area stretches from the Aravalli Hills across the Thar and Sind deserts into Baluchistan. Here very little rain falls, there are few wells and so the population is thin. In Baluchistan there are only eleven persons to the square mile. Burma, though it receives plenty of rain, except in the dry zone, is thinly peopled. Outside of the Irrawaddy Valley and coast strips the country is full of mountains, jungles and forests. Before it became part of the Empire, it was badly governed and fighting and robberies were frequent. Since then the population has greatly increased.

In India, just as in other parts of the world, there are reasons why more people live in some parts than in others.

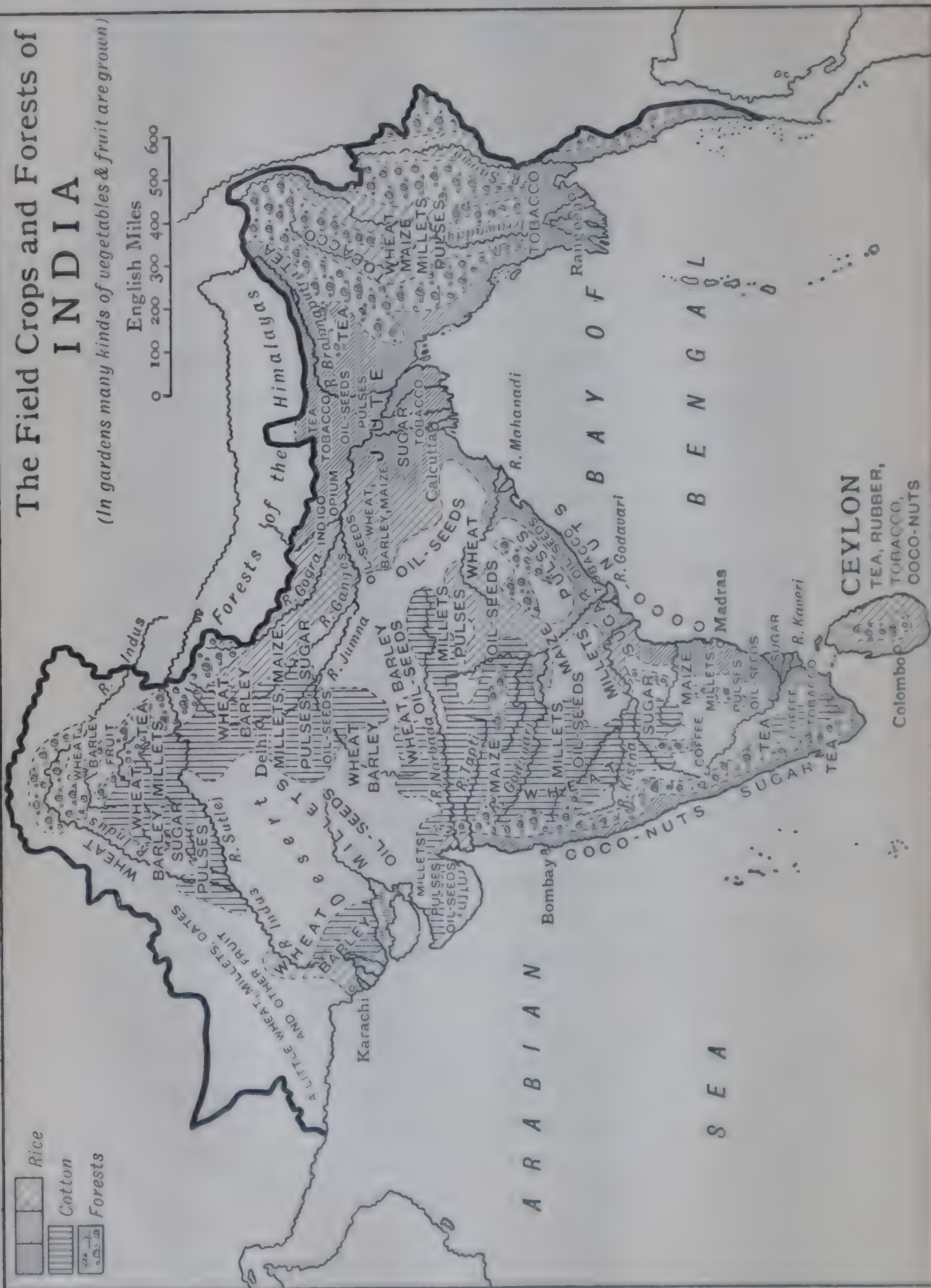
CHAPTER XXXII.

PRODUCTS OF THE INDIAN EMPIRE.

WE have learned that most of India lies in or near the hot belt of the world. There is always plenty of heat except on the mountains. Thus the people, unlike those of cold countries, need wear only few and light clothes. They can spend much of their time in the open air. Their houses protect them from heat rather than from cold. Thus many of these are built of bamboo, wood, straw and clay. Even those built of stone have open windows and verandahs, which are not found in cold countries. In the heat of the day people rest in the shade. Like the people of other hot countries they live chiefly on vegetable food.

The chief industry is **Agriculture.** About two-thirds of the population get their living by tilling the fields, pasturing cattle, goats and sheep, or by working in the forests. Thus, India is a country of villages surrounded by fields. In these villages live smiths, carpenters, weavers and potters, making things which the people need.

Forests.—In the mountain regions few crops can be grown, even where plenty of rain falls. It is difficult to plough land on steep slopes covered with thin soil and full of rocks. Here we expect to find forests and jungles, where the hill tribes live by grazing cattle and hunting in the forests. India has very large forests on its hills and mountains. The teak, the king of our forests, grows on the wet Western Ghats, in Assam and on the mountains of Burma. The timber is very hard, with but few knots, and the white ant will not touch it. In Burma and Malabar it is floated down to the coasts, sawn into planks and



The Field Crops and Forests of
INDIA
(In gardens many kinds of vegetables & fruit are grown)
English Miles
0 100 200 300 400 500 600
Rice
Cotton
Forests
Forests of the Himalayas
ARABIAN SEA
BAY OF BENGAL
CEYLON
TEA, RUBBER, TOBACCO, COCO-NUTS
Colombo
Madras
Calcutta
Bombay
Karachi
Delhi
Rangoon
R. Indus
R. Sutlej
R. Gogra
R. Ganges
R. Jumna
R. Brahmaputra
R. Mahanadi
R. Godavari
R. Kistna
R. Kaveri
R. Narbada
R. Tapti
COCO-NUTS
SUGAR
JUTE
WHEAT
BARLEY
MILLETS
PULSES
OIL-SEEDS
MAIZE
TEA
COFFEE
TOBACCO
OPIUM
INDIGO
FRUIT
A LITTLE WHEAT, MILLETS, DATES
A LITTLE AND OTHER FRUIT

exported from seaports such as Rangoon, Moulmein, Calicut and Mangalore. The sal grows chiefly on the Eastern Ghats, on the hills of Central India and the Eastern Himalayas. There are many other timber trees in India. Redwood and ebony are found on the Western Ghats, and ebony in Mysore. Bamboo is plentiful in almost all forests. More and more paper is being made from the pulp of wood and grass of these forests. Chief among the palms are the coco-nut, which loves sandy soil near the sea, and the palmyra, which grows almost everywhere. Parts of hill forests have been cleared to make room for tea and coffee gardens. Tea flourishes best on the hills and valleys of Assam, for the constant showers bring out the young leaf-buds from which the best tea is made. Other plantations are found on the hills round Darjeeling and in the Punjab. Tea is also cultivated on the Nilgiri Hills and on the Western Ghats in Travancore state. Very large quantities are exported. Coffee is chiefly grown on the drier or landward slopes of the Ghats in Mysore, Coorg, Travancore and on the Nilgiris. Much of it is shipped abroad from Mangalore. The cinchona tree, from the bark of which quinine is prepared, is also cultivated on the Nilgiris and at Darjeeling.

Crops of the Plains.—The Indo-Gangetic Plain, owing to the rich alluvial soil, the plentiful rainfall and the large number of rivers, is the most fertile part of India. Rich harvests of rice, millets and pulses, sugar, oil-seeds, wheat and barley are reaped, as well as of cotton and jute. The eastern part of this plain, made up of Bengal and the flat, low-lying parts of Assam and Bihar, receives most rain. Here, therefore, rice is the chief crop. The flat, well-watered lands bordering the Bay of Bengal are one of the most important rice-growing parts of the world. Bengal is one huge paddy field. Large parts of it are flooded in the rains when the rivers overflow. Sugar-cane, which also needs plenty of water, is also an important crop. The lowlands of Bengal, Bihar and Assam also produce large crops of jute. In fact Bengal grows more of this fibre than all the rest of the world. About one-half of the jute is exported : the other half is spun and woven in Calcutta mills and exported as coarse

cloth and sacks. In the drier parts round the villages are fields of millets and pulses, oil-seeds and tobacco. In the cold season some wheat and barley are grown in inland districts. Round Patna opium is made from the white poppy. But less is grown than formerly, when it was exported in large quantities to China.

In the middle part of the Plains, and in the United Provinces, less rain falls, but there are many rivers useful for irrigation. Here, therefore, less rice is grown, but there are large crops of other food grains, such as millets, oil-seeds and spices. In this province about half the total sugar-cane crop of India is reaped. In the cold season wheat and barley are very widely grown. Still farther west, in the Punjab, still less rain fails, and much of the cultivation depends on irrigation canals (the largest in the world) on the Five Rivers. Millets, pulses, oil-seeds, sugar-cane and a good deal of cotton are grown. In the cold season the lands watered by the Five Rivers produce large harvests of wheat and barley. They are sent by rail to Karachi and shipped abroad. The Punjab is one of the world's suppliers of wheat. Sind receives very little rain. Most of the fields have to be irrigated from the Indus and new canals are being dug. Only a little rice can be grown. Millets and cotton, in the hot season, and wheat and barley, in the cold, are the staple crops. When the new irrigation works in Sind are finished, the output of cotton will be enormously increased. Gujarat does not get enough rain to grow much paddy, but there are good harvests of millets, pulses and oil-seeds. Cotton is also a large crop, and supplies the mills of Ahmadabad and Bombay.

Crops of the Table-Land.—A rainfall map shows that this part of India receives a good rainfall in most places. But, as the rivers, not being snow-fed like those of the Plains, dry up in the hot season, there are but few irrigation canals. The soil, also, is not nearly so fertile as that of the alluvial Plains, and there is a good deal of jungle, waste and hilly land. The best land is in the valleys of the rivers. In certain parts, too, in Berar, the Central Provinces, the Bombay Deccan,

Hyderabad state and in the Madras parts of this table-land, there are fertile stretches of black cotton soil which can retain moisture for a long time. There maize, millet and cotton are chiefly grown. These districts send the raw cotton to local mills, as well as to those in Bombay. Bombay city is the chief market for cotton in India. Wheat and barley are cold weather crops in the northern part of the Table-land.

Crops of the Coast Strips.—On the low-lying coast-strips it is different. The heavy rainfall, the many small rivers and the alluvial soil of the Konkan and Malabar coast suit rice. In many parts two and even three crops a year are reaped. Sugar-cane is another important crop. Along this coast there are miles and miles of coco-nut groves, and the nuts, copra and coir are exported from the seaports such as Calicut and Mangalore. Pepper, the dried fruit of a creeper, is another export. The chief crops of the east coast are rice and sugar-cane, grown on the large fertile and well-watered deltas, on the banks of rivers and under hundreds of tanks and wells. In the districts which depend on rainfall 'dry' crops, such as millets, maize, oil-seeds, gram and other pulses, are grown round the villages.

We thus see that India is a very fertile part of the world, and grows a large number of food plants. If it were not so, how could the thirty-two crores of people in it get their food ? In seasons when the monsoon is good, people grow enough for their own needs and have some left over to export abroad in exchange for manufactured goods. Burma grows more rice than it needs and sends ship-loads to India. Though India has more sugar-cane fields than any other country, yet much sugar is imported from Java and Mauritius. In recent years, owing to poor rainfall, she has imported wheat from Australia. But though India produces large harvests, these could be greatly increased by better methods of cultivation and by improving the seed used. Better kinds of rice, wheat, sugar, cotton, jute, indigo, oil-seeds and fodder plants are being grown on Government farms, and the seeds of these varieties are sold or given free to cultivators. If these are widely sown, the crops

can be greatly increased in amount and in value. Good seed can be as easily cultivated as poor seed and it gives a much better harvest.

Animals and animal products.—In an agricultural country such as India the people tame animals to help them in their work. In every village bullocks are trained to plough the fields; ponies, donkeys and mules are used as carriers. Camels do this work in the dry and desert parts of the north-west. Yaks, strong shaggy bullocks, carry goods up and down the steep slopes of the Himalayas. Ghi and curd are made from the milk of cows and she-buffaloes; goats are kept for their milk and flesh; most villagers breed poultry and the lower castes eat the flesh of their pigs. All along the sea-coasts and in the rivers many kinds of fish are caught in nets. Animals supply us with other things besides food. The skins of sheep and goats and the hides of buffaloes and bullocks are tanned into leather. From the wool of sheep blankets and warm cloth are woven. The ivory of elephants, the horns of cattle and sea-shells are carved into ornaments. On the Malabar coast oil and soap are made from fish. Pearls are got by divers in the Gulf of Manaar. Silk is a fine thread spun by a kind of grub called the silkworm, which feeds on the leaves of trees. Tasar silk is got from grubs which feed on jungle trees in Assam. The best Indian silk is spun by silkworms fed on mulberry leaves in the United Provinces and Bengal. Lac is a kind of yellow gum secreted on the branches of trees by an insect. From this lac dyes and varnish are manufactured. More lac is found in India than in any other part of the world. It is often called shellac.

CHAPTER XXXIII.

PRODUCTS OF THE INDIAN EMPIRE—Continued.

MINERALS.

BESIDES using the earth to grow crops and feed animals, man digs beneath the surface for useful minerals. Though the Indian Empire is very large, it does not produce many minerals for its size.

Clay, Sand, Lime.—Common clay for making pots and bricks is found in most parts, but especially in the alluvial valleys. Fire-clay, from which fire-bricks are baked, is dug up in a few places. Fire-clay mixed with sand is used in tile-making. It is largely found in the west coast-strip round Mangalore. The pure sand, out of which glass is made, occurs only in small quantities, and most of our glass-ware is imported. Lime is obtained by burning limestone, which is found in the rocks of the table-land. In the alluvial valleys lumps of 'kankar' are dug up, and on the sea-coasts sea-shells are burned to make lime.

Building-stone.—Many kinds of fine building-stone are quarried. The hard granite of South India is one of the best. Here in every village and town we see temples built of this stone, which have stood for hundreds of years. The chief marble-quarries are in Rajputana, among the Aravalli Hills. In Delhi, Agra and Lahore are splendid palaces, tombs and mosques built of marble. The finest is the pure white marble Taj Mahal at Agra. But the rock most widely quarried is sandstone, which is found in large quantities in the northern part of the table-land region. Almost every important fort and building in the United Provinces is built of this stone.

Salt is obtained (1) by evaporation from sea-water at places along the coasts of Bombay and Madras; (2) from brine pits in the United Provinces, Rajputana and Cutch, and from the Sambhar Lake in Jaipur state. As we have seen, this salt is carried as fine dust by the south-west monsoon from the Rann of Cutch and the sea-coast; (3) rock salt is mined in the Salt Range of the Punjab, where there are pure beds of it 8 miles in length and 1000 feet thick. Saltpetre is found in the soil round villages in Bihar and other parts of the Plains.

Mica.—The mica deposits of India are the finest in the world and produce more than those of any other country. It is chiefly mined round Gaya and Hazaribagh in Bihar and Orissa province, and near Nellore in the Madras Presidency. Mica, being a good non-conductor of heat and electricity, is used in making furnace-windows, lamps and electrical machines.

Coal is the most important mineral mined in India. During the last forty years its production has so greatly increased that India can now supply her own needs. Unfortunately it is only found in a few places. Over 90 per cent. of the total output is got from the coal-fields of Bengal and Bihar and Orissa, at Raniganj, Jherria and Giridih. Assam, Hyderabad state (Singareni) and the Central Provinces produce a little.

Mineral Oil.—Almost all the petroleum found in the Indian Empire is pumped from wells in the Irrawaddy valley at Yenangyaung and Singu. There are also a few wells in the Brahmaputra valley in Assam, and near Attock on the Indus.

METALS.

In India there are ores of several metals, but at present they are, as a rule, not smelted here but sent abroad in the raw state. If smelting and refining works could be set up in India, many deposits, which are now not worth mining, could be used.

Gold.—The most important mines are at Kolar in Mysore state. Here the ore is found deep down in hard rocks which

must be brought up and crushed to powder in mills. There are other smaller mines in the same kind of rock in Hyderabad state. Alluvial gold in small quantities is found in river beds.

Copper is found in small quantities in Southern India, Rajputana and other places, but there are no important mines. As India uses a great deal of copper for vessels, etc., it has all to be imported.

Iron is found in many parts of India, but only in a few places are there iron mines. The chief of these are in Bengal, Bihar and Orissa. Here the ironstone is rich in metal, and it lies near the coal mines so that it can be cheaply smelted. The districts lying between the Hughli and the Mahanadi contain the principal coal and iron deposits at present worked in India. Recent discoveries of rich iron deposits in Bihar and Orissa seem to show that India possesses large stores of iron ore.* India is the largest producer of **manganese** in the world, and exports most of it as ore to Europe and Britain, where it is used to harden steel for tools. The richest mines are in the Central Provinces.

Lead, Silver, Zinc, Tin.—There are many deposits of lead in India and it was formerly mined in large quantities, but at present it can be imported more cheaply than it can be produced here. Recently large deposits of lead ore have been found and are now being mined at the Bawdwin mine in the Northern Shan States of Upper Burma. These mines also yield a good deal of silver and some zinc. India uses more silver than any other country in the world, but all, except what comes from the Bawdwin mine, has to be imported. Tin is also a product of Burma, which is one of the few countries where this metal is mined.

Wolfram, a metal used in the hardening of steel for guns and armour for war vessels, is, like tin, chiefly mined in Tavoy in Lower Burma. During the Great War the output was largely

* A recent report says that both in quality and quantity the ores of Bihar and Orissa are expected to exceed the greatest deposits in the United States, which have up till now been believed to be by far the most valuable in the world.

increased, and Burma now produces more wolfram than any other country.

Monazite, a metal used in making mantles for lamps, is found in the sand of the sea-shore in Travancore state.

INDUSTRIES OF THE INDIAN EMPIRE.

We have learned that the chief industry of India and Burma is agriculture. Most of the people live by cultivating the soil. In the forests are wood-cutters, charcoal-burners and others who gather lac, rosin and silk cocoons. In Rangoon, Calicut and in towns near the Himalayas there are large **saw mills,** which cut up into planks the timber logs floated down on rivers from the mountain forests. From wood-pulp, wild grass and bamboo, **paper** is made in mills. These are chiefly in Bengal. On the Malabar coast, where the coco-nut palm grows best, **coir** and **mats** are made from its husk, and **oil** is squeezed out of the dried flesh, or copra, of the nut. In the rice-growing districts of Bengal, Madras and in Rangoon, as well as in most large towns, many **mills husk and grind rice.** So, too, in the wheat-growing districts of the Punjab, Sind and the United Provinces, mills grind **wheat** into flour. Other mills make **sugar** out of cane and gur from the palmyra palm. Among the **tea**-gardens of Assam, Darjeeling and the Nilgiris, factories prepare the leaf. At Mangalore **coffee**, grown on the Ghats inland, is cured before being exported. In every cotton-growing district of Bombay, Berar, the Central Provinces, Madras, the United Provinces and the Punjab there are **gins** and **presses** preparing the raw cotton to be sent to spinning and weaving mills. The **handloom weaving** of cotton cloth has always been the most important industry of India next to agriculture, for everyone wears cotton cloth. Formerly India used to export cotton goods to Europe, but nowadays people in India wear cotton cloth made in steam mills either in India or Britain. Thus handloom weavers now make only the coarsest kinds of cloth, or special kinds such as turbans and saris. Fine hand-woven silk is made

chiefly in Bengal; coarse silk in Assam, where the raw silk is gathered from cocoons in the jungles.

Skins and hides are cleaned and tanned into leather in most provinces, especially in Bengal and Madras. The Madras tanneries are the best in India. Cawnpur is noted for its manufacture of many kinds of **leather goods,** such as boots, belts and saddlery. Sheep have good wool only in the colder parts of India, *i.e.* among the Himalayas. **Shawls, carpets** and **blankets** are largely made in Lahore, Amritsar and Srinagar.

The **mines** of India and the oil-wells of Burma give work to many people. More and more **iron** and **steel** are being manufactured every year, chiefly in Bengal not far from the coal and iron mines. Jamshedpur is one of the chief iron and steel producing places in India. Here Messrs. Tata have their works. The making of **brass** and **copper** vessels and ornaments is an important industry in India. They are made from sheets of brass and copper imported from abroad. Madura, Tanjore, Benares, Jaipur are some of the chief centres. Every silversmith must get his metal from abroad. Along the Malabar coast are many **tile-factories**. These 'Mangalore' tiles are used all over South India.

On the great rivers of the Plains and on those flowing across the Table-land, as well as on the Irrawaddy and other waterways of Burma, many people make a living as **boatmen** and **boat-builders**. We have seen that **salt** is made along the sea-board of Bombay and Madras Presidencies, and that all along the coasts of India and Burma there are fishing villages. At the seaports many **boatmen** are employed to take goods to and from vessels.

Cotton Mills.—By far the most important large-scale manufacture of India is that of cotton. Large steam mills spin the cotton fibre into thread and yarn: others weave the yarn into cloth. In every cotton-growing district these mills are at work, but far the most of them are in the Bombay Presidency, in and round Bombay city. Indian cotton has not so fine a fibre as American cotton. Thus the finest cotton cloth worn in India comes from England, which uses American cotton. Indian

mills cannot yet supply all the cotton cloth needed by the people. Still, Bombay mills export both yarn and cloth. The yarn goes to China and Japan, and the cloth to East Africa, China and Ceylon.

Jute Mills.—India is the greatest jute-growing country in the world. There are over seventy jute mills in India, and they are nearly all in Bengal where the raw jute is grown. Many of these mills are on the banks of the Hughli near Calcutta, where the raw jute can easily be brought to them by river-boats and barges. There the jute is woven into gunny bags and coarse cloth. Enough cloth is made in these mills every year to go thrice round the earth.

Oil-works.—At Syriam, close to Rangoon, the oil brought down the Irrawaddy in steamers is refined into petrol, petroleum, and naphtha, and out of it candles are made.

CHAPTER XXXIV.

THE TRADE OF INDIA AND BURMA.

(Chiefly with the Empire.)

Exports.—India and Burma we know are agricultural countries, where most of the people are engaged in tilling the soil. Compared with the countries of Europe or the United States they have few mines, and thus their manufactures are less important. Their chief exports will therefore be the products of their fields and gardens, of their pastures and of their forests.

1. **Products of Fields and Gardens.**—The chief food exports of the Indian Empire are **grain** and **pulses.** Thus enormous quantities of rice, from Bengal, Madras and Burma ports, go to England, Ceylon, the Straits Settlements, Mauritius, Natal and Zanzibar. Rice follows the Indian coolie wherever he goes abroad. Part of the rice sent to England is made into starch. From the Punjab and Northern India large shipments of **wheat** are sent through Karachi and Bombay, chiefly to England, where bread, made from wheat flour, is the main food of the people. Great Britain does not grow nearly enough wheat to feed her own people. During the Great War large quantities were sent to feed the Indian and other troops in Egypt. Spices, such as **pepper, chillies, cardamoms** and **ginger,** are also exported, chiefly from Madras ports. The pepper and cardamoms grown on the Malabar coast and its hills are mostly sent to England; the chillies go to Ceylon.

Tea. Almost all English-speaking people in the Empire drink tea once a day at least. India and Ceylon supply tea to the rest of the Empire. Calcutta exports the Assam tea, Madras and Calicut the crop of the Nilgiris and Western

Ghats, and Colombo that of the Ceylon hills. **Coffee** grown on the Western Ghats is sent to Britain and Australia, chiefly from Mangalore. Some raw **tobacco** goes to England, and Indian and Burmese cheroots find their way to the Straits Settlements, Aden and other ports on the Indian Ocean.

Oil-seeds.—Ceylon and the Straits Settlements take most of the seeds used in curries, just as they take a great deal of rice, for Indian coolies who have gone abroad to work in tea-gardens or rubber plantations. But the most important oil-seeds, such as **castor, coco-nut, ground-nut, linseed, mustard** and **sesamum,** go to England, where they are used partly as food for men and cattle and partly in other ways.

Besides food-crops the Indian Empire grows large quantities of **fibres,** and sends them abroad to be spun and woven. **Raw jute** is one of the largest exports. Grown in Bengal, it is shipped from Calcutta and goes to Scotland (Dundee) to be made into canvas and carpets. **Raw cotton** is shipped from Bombay and Madras ports to England, which is the greatest manufacturer of cotton cloth in the world. A good deal also goes to Hong Kong to be spun and woven in Chinese mills and looms. Great Britain takes almost all the **hemp** exported from India, to be spun into ropes, and a large share of the **coir** or coco-nut fibre of the Malabar coast.

2. **Products of Pastures.**—From her enormous herds of buffaloes and cattle and flocks of goats and sheep India provides Great Britain with ship-loads of **raw hides** and **skins,** chiefly from Bengal and Madras. In Great Britain everyone wears boots and shoes, and many leather bags and belts are used. Some **ghi** goes with the rice to the Straits Settlements, and during the Great War a good deal was sent to Mesopotamia for the use of the troops. The **raw wool** of Northern India is bought by Britain to be spun and woven into cloth.

3. **Products of Forests.**—Timber goes chiefly to Great Britain. **Teak** and **sandalwood** are the most important. Burma sends most of the teak,* for it is the best in the world, but some is also

* Burma supplies about 90 per cent. of the timber exported from the Indian Empire.

shipped from Calicut. The **sandalwood** goes from Madras ports. Of the **raw rubber** exported from the Indian Empire to Britain, Madras and Burma send about a half each. When new plantations grow up, the amount exported will largely increase. **Cutch** is exported from Burma and **lac** from Calcutta.

4. **Products of Mines : Coal.**—Bengal coal is shipped from Calcutta, not to Europe where there are better mines, but to ports like Madras, Colombo, Penang, Singapore, Rangoon and Aden for the use of steamers. Burma now ships some **oil-fuel** for the use of ships which burn oil instead of coal. Nearly all the **lead** exported from Burma mines goes to England, but Ceylon takes some to line tea-boxes. Most of Burma's **tin** goes to Singapore to be smelted before being sent to Europe. The **wolfram** of Burma which, before the war, went to Germany, now goes to Great Britain. Burma **rubies** are the finest in the world. Most of the large exports of Indian **manganese** is shipped to England from Calcutta and Bombay. We may say that Burma exports all the metals, except manganese, which are supplied to England by the Indian Empire. Bengal and Madras send **mica.**

5. **Manufactured Goods.**—We have seen that in India there are many mills, where cotton and jute and even some silk and wool are spun and woven. Bombay is now the chief centre in Asia of the manufacture of **cotton yarn** and **cloth** of various kinds and it ships them to ports along the shores of the Indian Ocean and to the East. Enormous quantities of **twist** and **yarn** are sent from it to Hong Kong, the Straits Settlements and Egypt to be woven in local looms. So, too, many different kinds of **cotton cloth, called piece goods,** are shipped from its mills to Ceylon, Aden, Egypt, East Africa, Mauritius and Australia. Of this trade Madras has a small share.

While Bombay spins and weaves cotton for ports on the Indian Ocean and the East, Calcutta makes **jute cloth** for the whole world. It spins and exports some jute yarn, and it weaves and exports a good deal of canvas. But its chief export is **jute gunny bags,** which are sent especially to those countries which export grain and other things carried in sacks. Shiploads are sent to England, Ceylon, the Straits Settlements,

Hong Kong, Cape Colony, Australia and New Zealand. Wherever in any part of the world we see a jute gunny bag, we may be nearly certain it was made in Calcutta from jute grown in Bengal. During the War millions of bags were sent to the armies in France to be filled with earth to protect the trenches, and miles of jute canvas were used to hide roads from German gunners.

Besides raw hides and skins, **tanned hides** and **skins** and **leather** are sent abroad in large quantities. They almost all go to England from Calcutta and Madras. During the Great War this trade was more than doubled, because millions of boots, belts and saddles were needed for the armies.

IMPORTS.

What does the Indian Empire get in exchange for the goods it sends abroad ? To answer this question we must remember three things. First, there is a very large population in the Indian Empire, larger than that of any other country. Secondly, the people live chiefly by tilling the soil and rearing cattle. Thirdly, there are few manufactures except the spinning and weaving of cotton and jute and these plants both grow in India. Owing to the large population we should expect a good deal of food to be imported. As there are few manufactures we do not expect to find there are large imports of raw materials. But we may be sure there must be large imports of manufactured goods for the use of the large population. We shall take these three kinds of imports in turn.

1. **Food, Drink and Tobacco : Food.**—India and Burma produce almost all their staple food such as rice, millets, pulses and wheat. But there are millions of people to be fed. Some of them use kinds of food which they do not produce at home. Most people would be surprised to see the large shipments of **provisions**, prepared or cooked, which come to India and Burma. Biscuits, foods made of flour, fruits in cans and bottles, condensed milk, jam, cheese and cocoa are largely imported. In India these are chiefly for the use of Europeans,

but Hindus and Mohammedans are yearly consuming more and more. In Burma, where there is no caste, much food of this kind is eaten, and Burma imports more of it than any province in India. **Jam,** made from fruit and sugar, now comes from Australia. **Coco-nuts** are shipped from the Straits Settlements and Ceylon and the Maldive Islands, where they grow plentifully. Baluchistan and Afghanistan send apricots. Large quantities of dried and fresh **dates** are brought to Bombay and Karachi from the shores of the Persian Gulf, where they grow well in the hot and dry climate.

Sugar.—Though India and Burma grow more sugar-cane than any other country, and have thousands of palmyra palms, they import a great deal of sugar. We must remember the enormous population of the Indian Empire, and that every man, woman and child eats some sugar or sweetmeat every day. Sugar, therefore, is imported in large quantities. Only a little of this sugar comes from England, which gets it from the West Indies or the beet fields of Europe. Almost all the Empire-grown sugar brought into India comes from the island of Mauritius, though more and more is being sent from the Straits Settlements and from China through Hong Kong. Of foreign sugar the island of Java sends us the largest supplies. Before the War India bought a good deal of beet sugar from Austria.

Spices.—It may surprise us to know that India and Burma together import nearly twice as much of spices as they export. The reason is that Indians and Burmese are fond of curries and highly spiced food. Even the poorest like a relish to their meals of rice, pulse or millet. **Cloves** come almost entirely from Zanzibar, the island off the east coast of Africa. The Straits Settlements send some **pepper** and **nutmegs,** which grow well in their hot, damp climate, and Japan sends a little **ginger.** But the largest import is that of **betel nuts,** shipped from the Straits Settlements.

Salt.—We can understand that an enormous quantity of salt is eaten. India does not make or mine all this salt. A good deal is imported from Britain, Egypt and Aden. Bengal has a dense population, its coast line is short, and the heavy rainfall

and the large number of rivers flowing into the sea makes it difficult to produce salt from sea-water. Thus Bengal imports more foreign salt than any other province.

Tobacco.—Neither India nor Burma imports many cigars from foreign countries ; almost every smoker uses Indian or Burmese cheroots. But millions of cigarettes are imported every year, especially into Burma. They come chiefly from England (where no tobacco grows), where they are made from leaf grown in the United States. A finer kind of cigarette is shipped from Egypt in smaller quantities.

2. **Raw materials.**—As India is not a manufacturing country, it does not import large quantities of raw materials. There are, however, one or two which we should remember. Much the most important is **oil,** especially kerosene, which is used in millions of lamps every night of the year. Burma, having its own oil-wells, does not need foreign oil. To India specially built steamers bring oil from the United States, Dutch Borneo and Rangoon. The United States also send much of it in tins. If we remember the long railway lines in India and Burma and the many steamers that visit our harbours, we can easily understand that large quantities of **coal** and **coke** are needed for their use. The coal mines of Bengal cannot supply it all, and some comes from abroad. Before the Great War it was imported from the coal mines of England, of Natal and of New South Wales, and among foreign countries Japan sends a little. During the War the importation of coal decreased very much, as Britain had to supply it to her allies, France and Italy. The great handicap of coal production in India is the cost of carrying it by rail to inland towns.

Wood.—Burma supplies herself and India with teak, but a good deal is also sent to India from the forests of Siam and Java. Deal and pine wood, which are soft and easily worked, come from England, where they are sent from Canada and Sweden, for in England there are no forests. A good deal of hard jarrah timber, used on railways, comes to India and Ceylon from Western Australia.

Fibres.—India imports some raw materials for spinning and

weaving, but very little comes from the Empire. Before the War England sent a good deal of **raw cotton,** most of it grown in America, and some also came from Egypt. This cotton was used in the Bombay mills. During the War this importation of raw cotton ceased, and Bombay got raw cotton from East Africa. **Raw silk** comes from China through Hong Kong and Chinese ports. Burma takes a good share of it. Victoria and New South Wales, with their large flocks of sheep, supply India with **raw wool,** and a good deal of foreign wool comes from Persia where sheep thrive well.

3. **Manufactured Goods.**—These make up much the largest part of the imports into the Indian Empire, for neither India nor Burma is a manufacturing country.

Textiles : Cotton, Woollen and Silk.—If we remember the enormous population of the Indian Empire, and that everyone in a hot country wears cotton cloth, we are not surprised to learn that the goods most largely imported are manufactures of cotton. Indian mills do not spin and weave nearly enough for the people. In the first place, enormous quantities of cotton twist and yarn, spun in the mills of Lancashire in England, are imported into India to be woven into cloth in local handlooms. Sewing cotton thread is another large import. Then there are many kinds of cloth which together make up the bulk of cotton goods imported. They are called piece goods, and include cotton cloth of many kinds, canvas, sheetings, cotton lace and cotton stockings and socks. Of this important trade Great Britain has much the largest share. India, being a hot country, does not need so many woollen as cotton goods. Woollen yarn and woollen cloth come from Britain. Persia sends woollen carpets. We get our silk thread chiefly from Japan and Italy, where silk-worms are reared in large numbers. Silk cloth is sent from Japan and China chiefly, but some also comes from silk mills in England.

Machinery.—In the Indian Empire but little iron is mined (though its output is increasing), and only a few machines can be made. But many machines are wanted and so they have to be imported. They come chiefly from Great Britain. If

you look at any engine or boiler you are almost sure to find its makers were an English or Scotch firm. Almost all the engines and machinery in the jute-mills of Bengal, the cotton-mills of Bombay, Madras, Cawnpur and other places, the rice-mills in Rangoon, the flour-mills of the Punjab and United Provinces, the cotton-presses in the cotton-growing districts, the mining machinery in the coal, iron and gold-fields, the engines of our river steamers, the machinery for preparing tea, for sawing wood, for making paper and printing books and newspapers in the large towns have been made in Britain and sent out here. In almost every bazaar you can see a tailor using an English-made sewing-machine. In every large office there is at least one typewriter. It has come from Great Britain or the United States. Every year hundreds of motor cars and motor cycles are imported. A good many come from England but most from the United States. Every year more machines are brought into India, and this is a sure sign that more work is being done in this country, and that the people are making more goods and are becoming wealthier.

Railway Plant.—A railway map of India and Burma shows how many thousands of miles of lines stretch in all directions, and we can understand how many thousands of engines and wagons run on these lines. Some of these engines, carriages and wagons are built in India, but they are made of iron plates which have been forged and hammered in Great Britain. Almost every rail on those long lines has been brought from England, and so have the iron sleepers on which the rails rest.

Tools.—Then think of the very large number of tools of all kinds made of steel which are used every day. They are nearly all forged and ground in the workshops of Birmingham and Sheffield.

Metals.—Besides machines and tools there are thousands of useful things made of metal which we see round us every day. They come from Britain and the United States. Here are some of the most important—tinned iron and galvanised iron sheets, nails, screws, bolts, beams, hoops, pipes, tubes, wire, brass for vessels, copper, silver and nickel for making coins.

Glass, another useful import, comes from different countries. The lamps and chimneys used in houses and the bangles and glass beads worn by thousands of women and children used to come from Austria. Since the War we have been getting them from Japan.

Horses and ponies.—The Indian Government imports ship-loads of horses for the use of the army. They chiefly come from Australia and are called walers. From the Persian Gulf ponies are shipped to Bombay and Karachi.

Coasting trade.—There is a large sea-trade carried on by Indian-owned craft and small steamers along the coasts of India and Burma. These vessels collect goods from the smaller ports where there are no harbours and take them to large sea-ports such as Calcutta, Bombay, Madras, Karachi, Rangoon and Colombo. This coasting trade is a busy one along the Madras seaboard, because here there are many small ports. A regular trade of this kind passes between Tuticorin and Colombo, and from the west coast ports to Bombay. Bombay ships cotton goods made in its mills to ports up and down the western seaboard and north to Karachi and the Persian Gulf. Coasting vessels from Basra and the Persian Gulf ports bring back dates, wool, carpets and some ponies. Calcutta sends Bengal coal to Madras, Rangoon, and Colombo to feed the steamers in these harbours and gunny bags to coast ports in India and Burma. Rangoon supplies petroleum, petrol and rice to Calcutta, Madras and Bombay and teak to other Indian ports.

CHAPTER XXXV.

THE POLITICAL DIVISIONS OF THE INDIAN EMPIRE.

The Indian Empire is divided up into provinces and states. Certain territories have from time to time come under the authority of the British Crown. These are under the administration of the Viceroy, who is assisted by an Executive Council, and a Legislative Assembly which passes laws for India. The larger provinces have governors and councils which have charge of their own local affairs. These territories are usually marked red in maps.

India is now divided into fifteen administrations :—Madras, Bombay, Bengal, United Provinces of Agra and Oudh, the Punjab, Burma, Bihar and Orissa, Central Provinces and Berar, Assam, North-West Frontier Province, Ajmer-Merwara, Coorg, Baluchistan, Delhi, Andaman and Nicobar Islands.

Besides these there are a number of Native States within the boundaries of India, under British protection but not under British jurisdiction. These are The Rajputana Agency (a group of 18 states), The Central India Agency (a group of some 150 states), Hyderabad, Mysore, Baroda, Gwalior, Kashmir, Sikkim and the states connected with Madras, Bombay, Bengal, the United Provinces, the Punjab, Burma, Bihar and Orissa, the Central Provinces, Assam, the North-West Frontier Province and Baluchistan.

THE PRESIDENCY OF BOMBAY.

This province consists of a long strip of land, varying from 200 to 300 miles in breadth, and extending inland from the

Emery Walker Ltd. sc.

FIG. 70.

Arabian Sea. Its northern shores are much broken by the delta mouths of the Indus, by the shallow waters of the Ranns and the Gulf of Cutch and by the Gulf of Cambay. Here the coasts are low and the sea shallow, so that there is no suitable place for a large, deep harbour. The southern half of the coast is different. It is but little broken, except by the fine harbour of Bombay, protected from storms by the island of the same name. Nor is the coast here flat, for, close behind it, rise the long ranges of the Western Ghats, extending farther south than the southmost limits of the province.

North of the Ranns of Cutch and the Indus delta, and lying between the bare Khirthar Hills in the west and the Thar Desert in the east, is Sind. Here the rainfall is very light—in some places less than 5 inches in the year. Thus a great deal of Sind is flat sandy desert, the only cultivation being along the banks of the Indus, from which canals are dug to carry the flooded waters of the river on to the fields of cotton and rice. South of Sind lies Gujarat, including the peninsulas of Kathiawar and Cutch and a strip of the mainland up to the foot of the Aravallis. Here the monsoon rains are heavier, and on the coast lands grow millets and pulses, and some wheat and cotton on the black soil. The most fertile parts of Gujarat are near the Narbada but, as we go north, the rainfall decreases and the soil becomes sandy. Kandesh is a fertile tract with rich black soil, extending eastwards from the coast and watered by the Tapti. The monsoon rains are blown up the Tapti Valley and large food-crops and cotton are grown. The Konkan coast, *i.e.* the narrow low-lying coast-strip between the Ghats and the sea, and stretching from the mouth of the Tapti right down to the southmost point of the Presidency, gets plenty of rain and is crossed by many short rivers flowing from the Ghats. It is, therefore, a country of rice-fields and coco-nut groves. Behind the Ghats lies the Bombay Deccan, stretching inland for more than 150 miles. This tract is drained by the head streams of the Godavari, the Bhima and the Kistna flowing eastwards. These rivers have strips of fertile soil along their valleys but, on the whole, as the

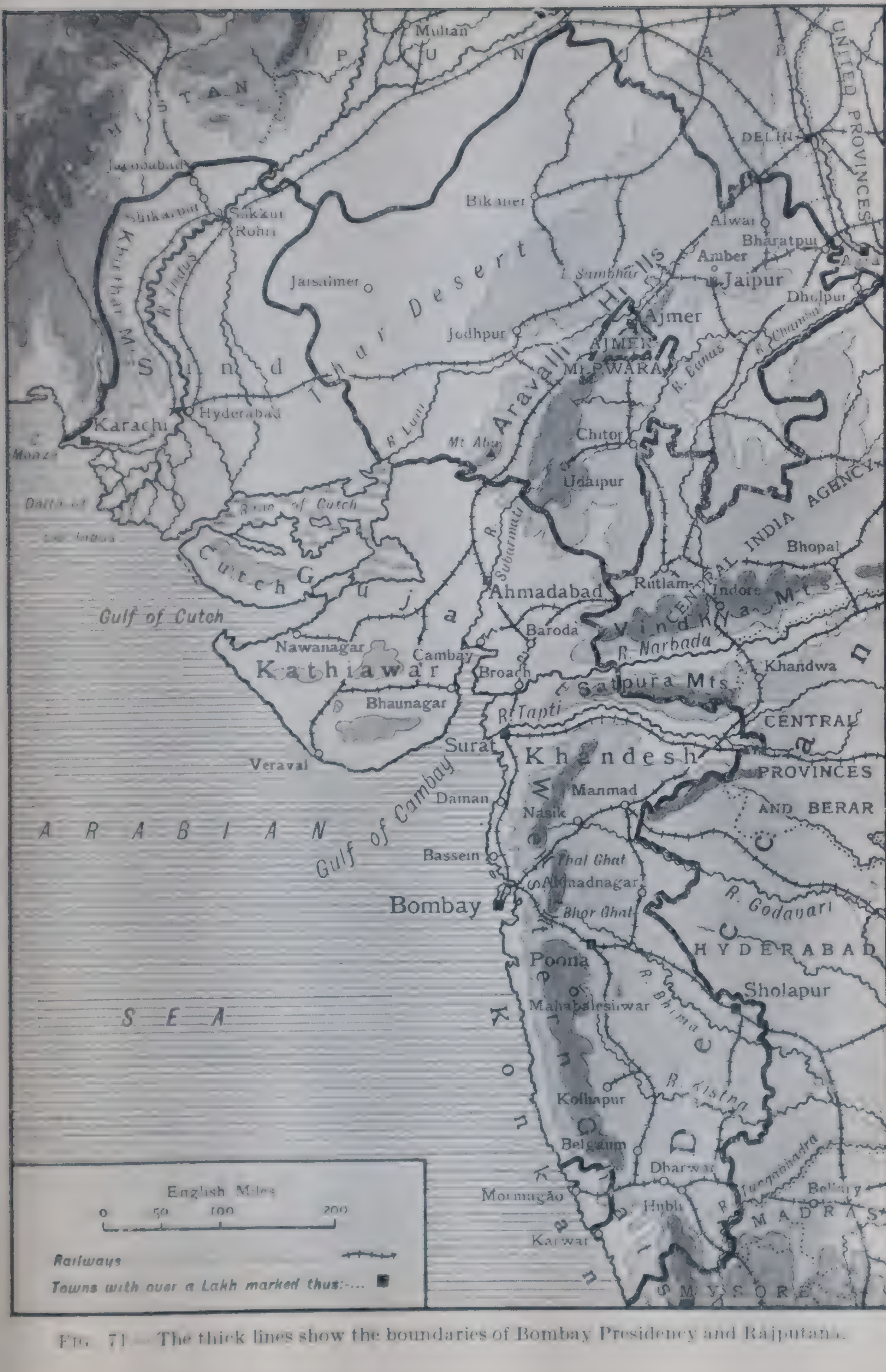


FIG. 71.—The thick lines show the boundaries of Bombay Presidency and Rajputana.

Ghats keep off the moisture-bearing winds coming from the sea, this part of Bombay Presidency is nearly treeless and is very dry for eight months in the year. In the southern parts of it rainfall is more certain, and Dharwar, Hubli and Belgaum are centres of cotton-growing districts. The chief food-crops on the drier lands are millets and pulses.

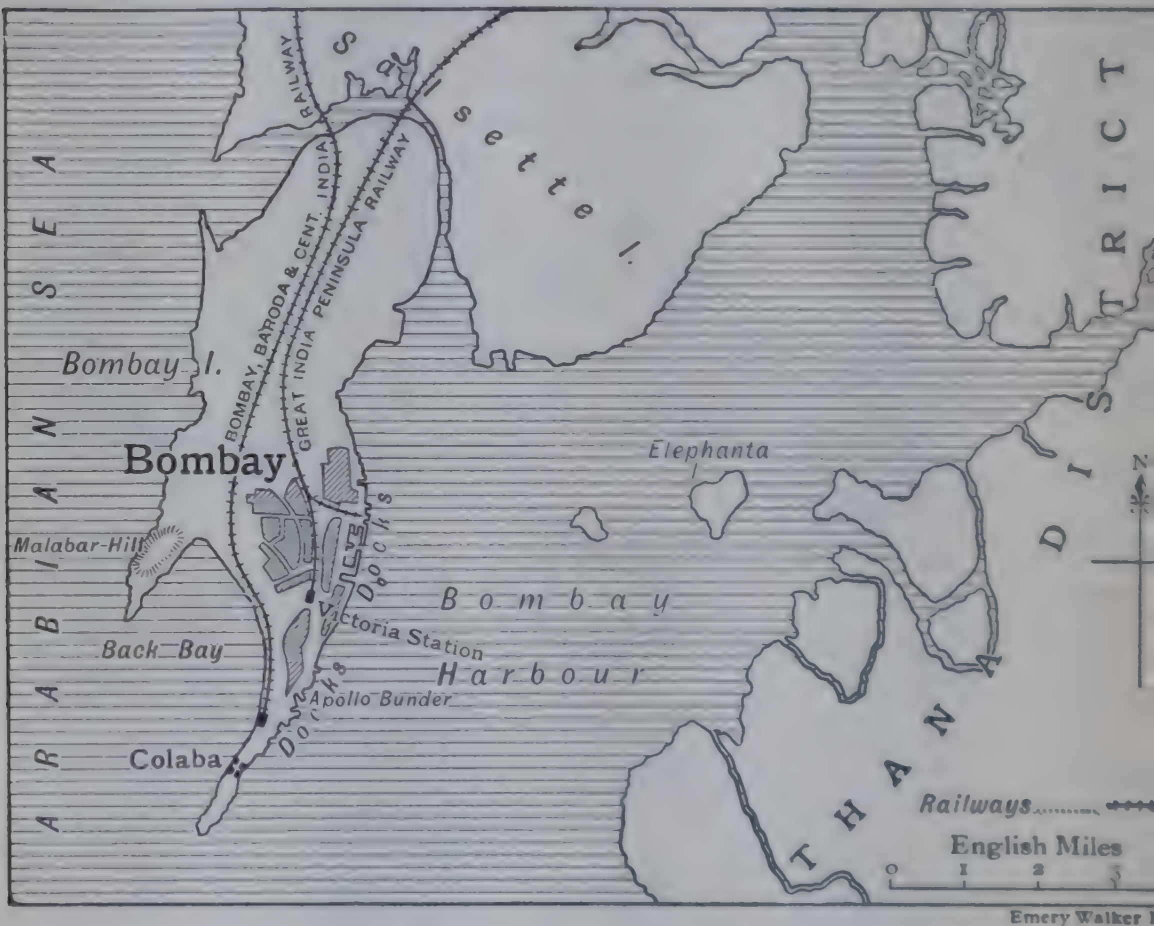


FIG. 72.—Bombay island, town and harbour.

Towns.—We have already learned why **Bombay** is so important. It has a splendid harbour and docks on the lee side of an island which is now connected with the mainland. This harbour lies nearer to the Suez Canal, *i.e.* to Europe, than any deep-water port in India except Karachi. On the land side Bombay is nearer the centre of India than any other port, and so it commands a wide area from which to draw traffic. Again, close to Bombay lie the great cotton-growing districts of Gujarat, the Central Provinces, Berar and the

FIG. 75.—The landing place at Bombay. The large harbour is protected from the sea by an island

Bombay and Madras Deccan. This is one reason why it is the chief centre of cotton manufacture—spinning of yarn and weaving of cloth—in India. The cotton mills are driven by electricity, generated by water led in long pipes down the steep slopes of the Ghats. This cotton trade helps its sea-trade, for Bombay exports cotton goods to ports on the African and Asiatic coasts of the Indian Ocean, the Straits Settlements, China and Japan. The city has one disadvantage of position. It is cut off from easy communication with the interior by the steep slopes of the Ghats. But this difficulty has been met by railways made north-eastwards over the Thal Ghat and south-eastwards over the Bhor Ghat. A railway passing along the low coast also connects it with Ahmadabad and the north.

Karachi, at the northern end of the Indus delta, has a good natural harbour, which, by the help of breakwaters, has been improved, so that it can be used by ocean steamers. Its position makes it important, for, as the map shows, it is the sea-gate of the Indus valley. Railways connect it with the fertile, irrigated lands of the Five Rivers, and it exports the wheat and cotton grown there. Without these railways Karachi would have no trade at all, as the districts just inland from it are neither fertile nor populous. In the case of an attempted invasion of India from the north-west, Karachi would be the sea-base of the army of defence along the frontier. Almost all the sea-borne trade of Western India passes through these two ports.

Surat, near the mouth of the Tapti, **Broach,** at the mouth of the Narbada, and **Cambay,** at the head of its gulf, were formerly busy seaports trading with Africa and the Persian Gulf. But they have lost their sea-trade for two reasons. First, the sea near them is becoming shallower; second, since the Suez Canal was made, larger and larger steamers are being used in foreign trade, and those harbours are not deep enough to receive them. Bombay has taken from them almost all their foreign sea-trade. Surat is still a large town with many cotton mills. It exports the cotton grown in the Tapti valley.

Ahmadabad, on the Subarmati, which enters the head of the Gulf of Cambay, is a large and busy town, spinning and weaving the cotton grown round it, preparing leather and making paper. It is also an important railway centre in a fertile part of the province. **Poona,** the ancient Mahratta capital, stands on a high part of the table-land behind the Ghats, on the main line from Bombay to Madras. Here a narrow-gauge line strikes southwards through the cotton tracts of Belgaum, Dharwar and Hubli to Bangalore in Mysore state. **Baroda,** the capital of Baroda state, is another old Mahratta capital, but in modern days fine public buildings, such as colleges, hospitals and libraries, adorn the city. **Hyderabad** in Sind, at the head of the Indus delta, has a good deal of trade, as here three railway lines meet the river. **Sukkur and Rohri** are close to the bridge, farther up the Indus, which carries a railway across the river. From here a line passes through **Shikarpur and Jacobabad** and climbs the mountain slopes of the frontier by the Bolan Pass to Quetta, the chief military outpost in British Baluchistan. **Mormugao** (a Portuguese port) and **Karwar** do a good deal of coasting trade, but they cannot compete with Bombay. **Mahabaleshwar,** a hill station 4500 feet above sea-level on the Western Ghats, is a favourite resort during the hot season.

THE PROVINCES OF THE GREAT PLAIN.

THE PUNJAB, THE UNITED PROVINCES, Etc.

The Punjab.—A railway journey up the Indus valley from Karachi takes us to Lahore, the capital of the Punjab, near the centre of that province. The map shows the Punjab extends, in its north-eastern corner, into the Himalayas as far as the point where the Sutlej enters India. In the north it includes a table-land beyond the Salt Range between the Indus and Jhelam rivers. The rest, and much the largest part, of the province, is the western end of the Great Plain of India and slopes gently towards the Indus. This plain is watered by the main river and the Five Rivers which feed it. It is,

therefore, a land of doabs, but away from the rivers and canals the land is semi-desert owing to the light rainfall.

We might call the Punjab the Irrigation Province. No country in the world has such a magnificent system of

FIG. 74.—The thick lines show the boundaries of the Punjab, the N.W.F. Province and Kashmir.

canals and water channels. Nearly the whole cultivated area depends on water drawn from these canals. The summer monsoon passing up the Ganges valley has dropped nearly all its moisture before it comes so far west, and the clouds carried up the Indus valley, having nothing to stop them on the way, give little rain till they are dashed

against the Himalayas. Thus the parts of the Punjab farthest from these ranges get but little rain, and without irrigation they would be uncultivated. But they are saved by the rivers. These are spread over the country and they come from the Himalayas, where the rain and snow can feed them all the year round. In fact they are flooded at the beginning of the hot season when no rain falls in the plain, because then the snow on the mountains begins to melt. Again, the soil itself is fertile enough, for it is made up of the alluvium washed down from the mountains and spread over the plains by the rivers which have wandered over it, now here now there, for long ages. The plain is also very flat with no rocks, so that canals can easily be dug. Engineers have taken advantage of this, and by leading canals (and these feed smaller channels) from one river to another, they have spread a network of irrigation over large parts of the Punjab plain and have turned bare, treeless wastes into pastures, fields and gardens among which villages have been built. This work is not yet finished. Every year new plans are proposed by engineers for extending irrigation works both in the Punjab and Sind. These canals have greatly increased the area of cultivated land and the crops raised. In the hot season they fertilise the fields of millet, pulses, sugar-cane, cotton and even rice ; in the cold season wheat and barley are the chief crops. After the wheat harvest Karachi harbour is full of steamers loading cargoes of wheat sent down by rail from the irrigated fields of the Punjab.

Towns.—Most of the towns are in the eastern and northern parts of the plain where the rainfall is fairly heavy. **Lahore,** the capital, on the Ravi, and **Amritsar** stand close together near the centre. Amritsar is the holy city of the Sikhs and a busy trading town. From Lahore railways run in all directions. One line goes north-westwards through **Rawal Pindi,** on the table-land, to **Attock** on the Indus. These are both garrison stations for troops defending the north-west frontier. The line to Delhi passes **Jallundur, Ludhiana** and **Ambala** where troops are also quartered. **Multan,** on the railway to Karachi

is a busy market town, collecting the cotton, wheat, wool and other products of the surrounding districts and the fruits, dates and spices coming across the frontier from Kandahar on camel-back. There are several hill stations, of which **Simla** is the chief. We can reach it by a mountain railway. Here the Imperial Government carries on its work in the hot months.

Photocurom

FIG. 75.—The battered Kashmir Gate of Delhi City.

Delhi.—Delhi city and a small district round it now form a small province. The city, which is the capital of India, stands on the Jumna, and its history is the history of India. In the days of the Moghuls it was the residence of the Emperor, and it has many splendid palaces and mosques. Close by its walls are the ruins of six old Delhis. A new Delhi is now being built with courts, halls and offices for the use of the Imperial Government. Delhi is also a busy trading town, with cotton, flour and sugar mills and bazaars, where articles made of gold, silver, muslin, silk, ivory and wood are sold. Its position makes it the centre of the railway systems of Northern India.

From its stations lines run out to Lahore and the north-west ; to Bombay, through Ajmer or through Agra and Bhopal ; along the Ganges valley to Allahabad, Lucknow, Cawnpur, Benares, Patna and on to Calcutta.

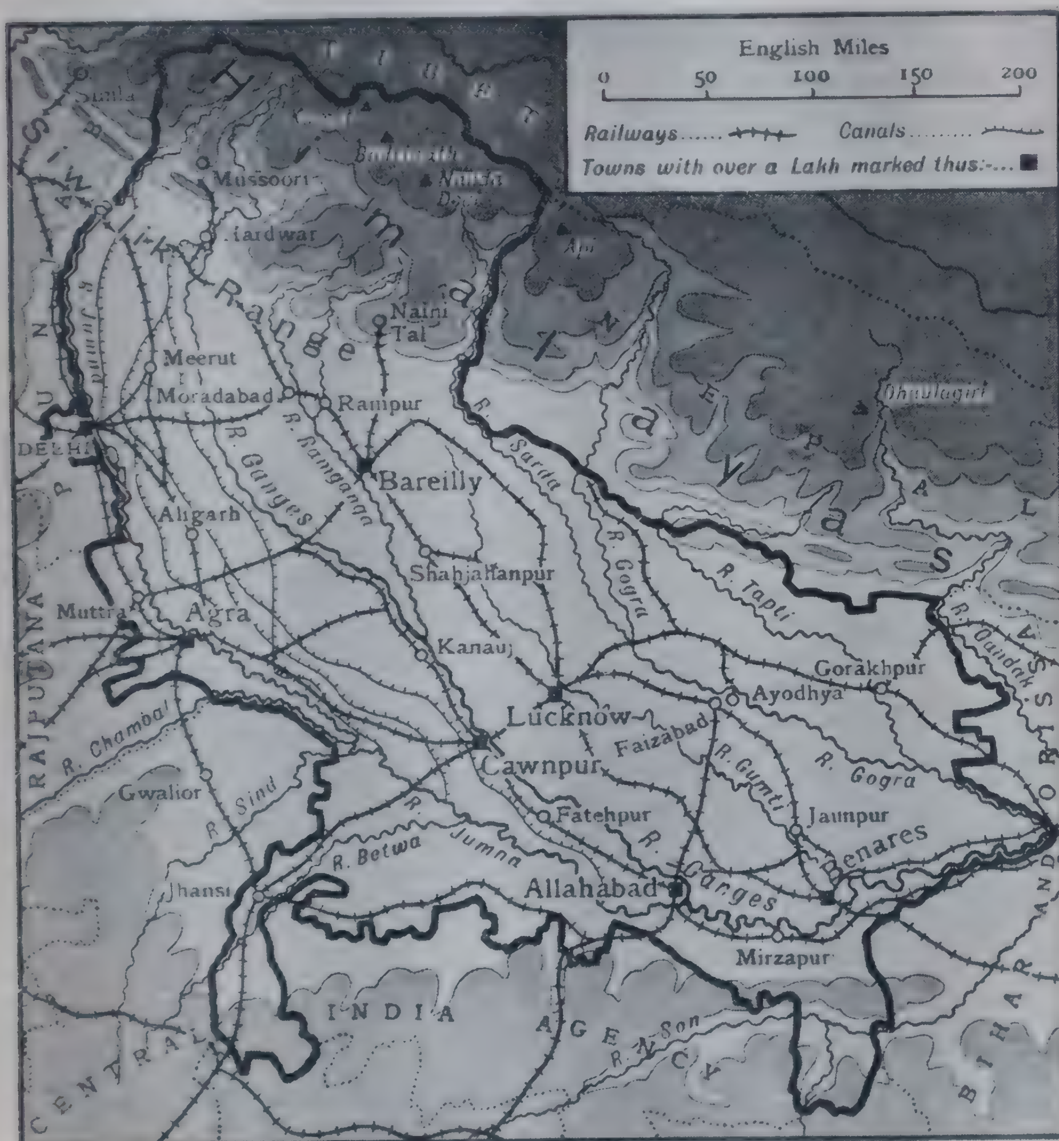


FIG. 76.—The thick line shows the boundaries of the United Provinces of Agra and Oude.

The United Provinces.—As soon as we cross the Jumna at Delhi, we are in the United Provinces. In the north they extend far into the Himalayas, including the Siwalik Range or sub-Himalayas, the forested outer Himalayas and the inner Himalayas, which here rise into the high peaks of Nanda Devi,

Kamet and Badrinath, all over 25,000 feet in height. Along the base of the hills stretches the Tarai, a wide belt of hot, marshy jungle and long grass, the haunt of tigers and elephants. Here the climate is very feverish. In the south the province includes a narrow strip south of the Ganges and Jumna, where spurs from the Central India part of the Table-land come down to the edge of the Great Plain. Neither of these two tracts is fertile or thickly peopled. Between them lies the largest and much the most important area of the province, namely, that part of the Great Plain of Northern India which stretches from the south of the Siwaliks south-eastwards nearly as far as Patna. Down this plain flow the Ganges and Jumna and several other large rivers which come from the Himalayas. This large flat area, being well watered by rivers and canals and receiving a good rainfall, is one of the most highly cultivated parts of India and grows more food (except rice) than any other province. The chief crops are wheat, barley, millets, rice, maize, pulses and sugar-cane. We are not surprised, therefore, to learn that the United Provinces are more densely populated and have more large towns than any other political division of India. These towns lie on the Ganges or its tributaries and are all connected by railways. This is the Madhyadesa or Middle Land, described in the sacred writings of the Hindus. In it are found the most sacred places, such as Benares (Kasi), Kanauj, Hardwar, Muttra and Ayodhya.

Towns.—The capital, **Allahabad**, is important because of its position at the meeting-place of the Jumna and Ganges, for it is not only the holy Prayag of the Hindus, but a centre of river traffic. At the present day it is also an important railway centre from which lines run out south-westwards across the Table-land to Bombay, north-westwards up the Plain to Delhi and Lahore and beyond the Indus to Peshawar, and eastwards down the Plain to Patna and Calcutta. This position makes it a busy trading town. Not far down the Ganges we come to the sacred city of **Benares**, full of temples and holy spots along its famous river-ghats, which make it a crowded place of Hindu pilgrimage. Brass-work, silk-cloth and jewellery are made in

the town. **Cawnpur,** farther up the Ganges from Allahabad, is not an old town like Benares, but it has in modern times become a busy city owing to its manufactures of cotton, leather, wool and jute. Tents, saddles, harness, boots and blankets are here manufactured for the use of the Indian army. In fact, Cawnpur is the largest and most important inland manufacturing town in the Indian Empire. **Agra,** on the Jumna, is

Photo. Bourne and Shepherd.

FIG. 77.—The Taj Mahal viewed from the top of the gateway.

both an old town and a busy modern market. Its magnificent sandstone fort contains some of the most beautiful buildings, and just outside the city is the world-famous 'bubble in marble,' the Taj Mahal, the matchless tomb which the Emperor, Shah Jehan, built on the Jumna bank in honour of his wife. Akbar's fort and palace at Fatehpur Sikri, a few miles from the city, are, in the opinion of some, equally worth visiting. At the present day Agra is a large grain market for the fertile country round about, and contains cotton mills, tanneries and leather works. **Lucknow,** on the Gumti, the capital of Oude,

is a large city full of mosques, palaces and gardens built by the Nawabs of Oude in days gone by, and its bazaars are full of silversmiths, goldsmiths, workers in muslin, silk, embroidery and ivory. There are many other important towns in this fertile and thickly populated province. **Mirzapur, Meerut, Aligarh, Bareilly** and **Moradabad** are the names of a few marked on the map. **Naini Tal** and **Mussoori** are two of the hill stations on the lower slopes of the Himalayas.

Bihar and Orissa.—At the eastern end of the United Provinces important tributaries enter the Ganges—the Gogra and Gandak from the Himalayas and the Son from the Central India part of the table-land. Just below their meeting-place stands Patna, the capital of Bihar and Orissa. This province is shaped like a long parallelogram stretching south from the foot of the Himalayas in Nepal to the Mahanadi delta on the coast. It thus contains (1) a part of the flat Ganges plain lying between Patna and the point where the Bhagirathi splits off southwards from the main river ; (2) the north-east corner of the Table-land, consisting of the uplands of Chota Nagpur and Orissa ; and (3) the lowlands of the lower Mahanadi basin and the part of the coast-strip formed by the delta of that river and of others which enter the sea north of it.

The most fertile and most densely peopled part is the Ganges plain. Here rice is the main crop, but maize, oil-seeds, indigo and some jute are also grown. Wheat and barley are winter crops. Formerly indigo was a most important crop in north Bihar, but for some years before the War the area sown with it was diminishing, owing to the discovery and manufacture in Germany of indigo dye prepared from chemicals. During the War, when supplies of German-made indigo were stopped, the price of natural indigo rose high and much more of it was grown in the province. Perhaps it will now become a smaller crop again. Opium used to be another important crop in this province and in the United Provinces and it was exported to China. But this trade was stopped by an agreement not to export, made between the Governments of India and China. Tobacco is also grown, and at Monghyr there is one of the largest

cigarette factories in the world. In recent years the mining of coal, iron and copper and the manufacture of iron and steel

FIG. 78.—The thick line shows the boundary of the Province of Bihar and Orissa.

have become important industries. There are some 450 coal mines in the east of the province bordering on the Raniganj

coal-field of Bengal. Iron is mined close to the coal and can thus be cheaply manufactured. Everyone has heard of Messrs. Tata's iron works at Jamshedpur (Sakchi).

Towns.—Most of the towns are river-ports on the Ganges or its feeders, such as **Chapra** on the Gogra, **Sonpur** on the Gandak. **Muzaffarpur** on the Bhari Gandak, **Monghyr** and **Bhagalpur** on the Ganges. **Patna,** owing to its position, was formerly the meeting-place of the water traffic on the Ganges, Gogra, Gandak and Son on its way to and from Bengal. River steamers ply up and down the river below Patna. But in modern times railways have taken away a good deal of the river trade. **Dinapur,** the cantonment, **Bankipur,** the civil station, and the trading river-port of Patna really form one long town, and a new Patna is being built a little farther from the river. **Gaya,** south of Patna, is a place of pilgrimage for Hindus, and near it is **Buddh-Gaya** with its sacred pipal tree and the ruins of Asoka's palace. **Ranchi** and **Hazaribagh** lie up on the Chota Nagpur part of the table-land. **Cuttack,** in Orissa. owing to its position at the head of the Mahanadi delta where the main (Calcutta-Madras) line crosses the river, is a centre of trade by rail, road, river and canal in a fertile district. **Puri,** on the southern shore of the delta, contains the temple of Jagannath and is a sacred place of pilgrimage.

Bengal.—When the Ganges, leaving Bihar, bends round the north-eastern extremity of the table-land and gives off its first distributary, the Bhagirathi-Hughli, it is in Bengal. The position of this province is very easy to remember. In shape it is a huge isosceles triangle with its apex at Darjeeling, high up in the Himalayas, and its base the low-lying, broken edge of the delta formed by the Ganges and Brahmaputra. On the east it is fenced in by the Assam and Lushai hills, and on the west it slopes gently upwards to the high land of Chota Nagpur. Bengal is thus a flat, triangular, low-lying plain into which rivers flow on both sides. We can understand how great must be the volume of water brought down by these rivers by looking at the map which shows that they drain all the eastern half of the Himalayas and the northern part of the Table-land.

FIG. 79.—The triangles of Bengal and Assam.

We might call Bengal a Wet Triangle. The whole of this flat triangle is built up of the deep, fine silt brought down by the two great rivers and their many feeders during long ages. Every part of it has been delta-formed. The present delta is being slowly built farther and farther out into the sea. Its seaward edge is formed by the Sundarbans, a network of jungles, estuaries, brackish lagoons and tidal marshes enclosing a

Photo. Johnston and Hoffmann, Calcutta.

FIG. 80.—Fishermen on the flat delta coast of Bengal.

number of low, swampy islands. The rainfall of the province is heavy, as the Bay branch of the summer monsoon sweeps in from the sea and dashes against the Assam Hills and the face of the Himalayas. This rain and the flooded rivers make Bengal one vast paddy field and the chief rice-growing province of India. It is also the most important jute-growing region not only in India, but in the world. Oil-seeds, pulses, sugar-cane and a little wheat and barley are other crops, and tea is grown on the hills round Darjeeling. The three chief industries are the spinning and weaving of jute in steam-mills on the banks of the Hughli, the preparation of tea in factories round

Darjeeling and the mining of coal (about 200 mines) chiefly round Raniganj close to the coal and iron-fields of Bihar and Orissa. There are, besides, several rice-mills, cotton-mills, sugar-mills and paper-mills.

Towns.—Bengal, owing to its fertility, is thickly populated. It is a land of villages and there are few large towns. These are mostly river-ports. Sailing up the Hughli-Bhagirathi we pass a dozen of them, of which **Chandarnagore, Chinsurah, Santipur, Krishnagar, Berhampur** and **Murshidabad** are a few of the most important. **Nainganj, Nasirabad, Sirajganj** and **Goalundo** are busy river-ports trading in jute and rice on the Brahmaputra and its branches. From Goalundo a line of steamers plies up the Brahmaputra as far as Sadiya, up the Ganges as far as Patna, and down the rivers of the delta.

Calcutta, the capital, is the largest and most important trading town not only of India but of Asia. We have already seen how its position, at the sea-end of a large fertile plain on a navigable tidal estuary up which ocean-vessels can come, has made it so important. Almost the whole of the sea-trade, not only of Bengal and Assam but of eastern India, passes through Calcutta. The exports are raw and manufactured jute (gunnies), tea, hides and skins, pulses and coal ; it imports and sends up country large cargoes of cotton goods, metals, machinery, mill-work and salt from England and sugar from Java. As a manufacturing town it is favoured by being near the Raniganj and Jherria coal-fields. Calcutta is also the focus of important railway lines. The East Indian and Bengal-Nagpur systems have their termini at **Howrah**, the part of the city lying on the right bank of the Hughli, for no railway bridge has yet been made across this tidal river. The East Indian lines connect it with all the towns up the Gangetic valley, and the Bengal-Nagpur Railway with Bombay and Madras. From Calcutta itself a line passes northwards over the delta, crosses the Ganges by the magnificent Hardinge bridge at Sara, and then goes on to the foot of the Himalayas where it is connected by a ' toy-railway ' leading up the slopes to **Darjeeling,** a hill station where snow falls in the cold season and

FIG. 81.—The Harbour of Calcutta on the Hughli River.

from which a magnificent view of Kinchinjunga can be had. On the east of the Ganges delta, twelve miles up a river flowing from the hills behind it, is the busy port of **Chittagong.** This seaport is connected by a line which runs inland by valleys across the hills of Assam as far as Sadiya. Chittagong is, therefore, the sea-outlet, by rail, of that province. **Dacca,** at the head of the Meghna estuary, is the only city in Bengal except Calcutta. Unlike Calcutta it is an old city. Formerly it was famed for its fine muslins ; at the present day, owing to its position on and near waterways in a jute-growing and rice-growing district, it is the most important inland mart of Bengal, collecting produce to be sent on to Calcutta. **Raniganj,** in the valley of the Damodar river, is now a busy centre of coal mines. Near it is Asansol, the railway junction from which coal is sent in all directions.

Assam, like Bengal, is a Wet Triangle. Its apex is far in the north-east where the Brahmaputra bends through the Himalayas, and its base coincides with the right leg of the triangle of Bengal. Unlike Bengal, however, it is not flat but full of hills running in ranges roughly north-east to south-west and separated by valleys. The longest of these valleys are drained by rivers which join to form the Surma, and that river splits up into two branches which form the delta of the Meghna. The northern leg of the triangle runs along the base of the Himalayas, and just south of this boundary stretches the broad, flat valley of the Brahmaputra.

The hills of Assam face the winds of the Bay of Bengal branch of the monsoon and the province receives a very heavy rainfall. Cherrapungi, on the hills north of the Surma valley or Sylhet Plain, has the greatest measured rainfall of any part of the world. Over most of the country rain falls during eight months of the year. The damp well-drained soil of the hills and the frequent rains suit the cultivation of tea, and Assam produces about two-thirds of all the tea grown in India. The staple food-crop is rice, grown in the rainy, well-watered valleys where little or no irrigation is needed. Jute is also a large crop in the low-lying lands bordering Bengal. The

heavy rainfall favours the growth of trees, and Assam possesses the largest area of virgin forest of any province of India except Burma. Some coal is mined in the north part of the province and supplies the river-steamers which ply up and down the Brahmaputra. The trade of the country is chiefly carried on by these river steamers, but more and more use is being made of the railways. These connect Calcutta with Goalpara, a port on the main river before it makes its bend round the hills into Bengal. The Upper Brahmaputra Valley and the Cachar Valley are joined by rail with Chittagong.

Photo. Johnstone Hoffmann.

FIG. 82.—Howrah Bridge, built on floating barges on the Hughli.

There are few industries except agriculture. Tea is prepared in factories on the tea-estates, wild silk is spun and woven in the forest villages, and on the rivers boat-building is carried on. Owing to the mountainous nature of the country there are few towns. **Goalpara, Gauhati, Tezpur, Sibsagar** and **Dibrugarh** are river-ports on the Brahmaputra sending down tea and timber and receiving salt and manufactured goods from Calcutta. In the Sylhet Valley **Sylhet** is the largest town, and **Silchar** lies farther up the river in the Cachar Valley. **Shillong**, to the north, is a healthy hill station and the seat of the Government of the province.

CHAPTER XXXVI.

POLITICAL DIVISIONS—Continued.

THE MADRAS PRESIDENCY.

A RAILWAY runs along the long eastern coast of India from Calcutta as far as Rameswaram, on Pamban Island, where a ferry steamer takes passengers across to Ceylon. Leaving Howrah station by the evening mail and passing Cuttack, we wake up in the morning as the train passes Chilka Lake, the southern shores of which are in Madras Presidency. The night mail from Bombay through Poona by the G.I.P. line takes us by the afternoon of the following day to Raichur in the Nizam's Dominions, close to the bridge over the Tungabhadra river and, crossing it, we are in the Madras province. Its boundaries can be traced on the map. If we cut off the end of the peninsula of India by a slanting line drawn from the Chilka Lake up the Kistna and Tungabhadra to the southmost point of the Bombay Presidency on the Arabian Sea coast and then cut out Mysore State and Coorg, all to the south of this line belongs to the Presidency of Madras. The map shows it has a longer coast-line than any other province and more seaports. It is, roughly, made up of the broader east coast-strip running back from the Bay of Bengal to the Eastern and Western Ghats; a narrow strip along the west coast (including the sea-board of Cochin and Travancore States); and a part of the Deccan Table-land, behind the Eastern Ghats, called the Ceded Districts.

This, the most southerly of Indian provinces, has a hot climate and can produce all the crops grown in India except wheat and barley, which need a cool, dry, ripening climate

FIG. 83.—The thick lines show the boundaries of Madras Presidency, Hyderabad State and Mysore State.

like that of Northern India in the cold season. Rice is a large crop and is planted wherever enough water can be had. The chief areas where it is grown are, therefore: (1) on the large deltas of the Godavari, Kistna and Kaveri, as well as on the irrigated banks of all the east-flowing rivers; (2) on the wet west coast, where heavy monsoon rain falls for several months in the hot season and which is watered by several short rivers flowing down from the Western Ghats; (3) under tanks where water can be stored in hollows. There are hundreds of such tanks in the Presidency. Scarcely any hollows are unused in this way. Sugar-cane is another crop grown on irrigated lands. The dry crops are millets, maize, pulses and oil-seeds, especially ground-nuts. Cotton is largely grown on the black soil of the Ceded Districts round Bellary, bordering on the Bombay Deccan cotton country, and in the south. Tobacco is also a large crop. Tea is cultivated on the Nilgiris and Western Ghats, and coffee on the lower ranges of these mountains. On the west coast-strip the long stretches of flat land on the banks of the back-waters are thickly planted with coco-nut groves. The forests of the Western Ghats produce a good supply of teak and other timber. As no coal and few minerals are mined in the province, there are no large centres of industry like Bombay, Calcutta or Cawnpur. Cotton mills in Madras and in the cotton-growing districts spin yarn and weave cloth, but they are few in number. Saw-mills in Malabar turn the teak logs, floated down to the coast, into planks. On the west coast there are several tile-works.

Towns.—A voyage along the coasts takes us past many sea-ports: **Vizagapatam,** where a deep-water harbour is to be built; **Cocanada,** the sea-outlet for the fertile Godavari delta; **Madras,** the only deep harbour; **Pondicherry** (French); **Negapatam,** on the Kaveri delta; **Tuticorin,** the chief trade port for Ceylon; **Quilon** and **Alleppey** (in Travancore State); **Cochin, Calicut, Tellicherry, Cannanore** and **Mangalore.** The ports on the west coast have a coasting and export trade in coco-nuts, coir, copra and pepper from the low lands, and in tea, coffee and timber from the hills behind. Mangalore exports more coffee than any other port in India.

Madras, the capital, is the only one of these ports which has a harbour deep enough to receive ocean-going vessels. It has recently been protected by large breakwaters but it cannot compare with Bombay or Karachi. The city and harbour are the starting-place of different railway lines—northwards along the coast to Calcutta, north-westwards across the Table-land to Poona and Bombay, south-westwards through the

FIG. 84.—A great temple at Hampi village on the banks of the Tungabhadra near Bellary.

Palghat Gap in the Western Ghats to Calicut on the west coast, along which the line runs north to Mangalore. Less than half-way to the coast this line sends off a branch which climbs a ghat into the Mysore part of the Table-land and reaches Bangalore. The South Indian line runs south from Madras down the coast and, to avoid the Kaveri delta, turns inland through **Tanjore** to **Trichinopoly** and then on to Madura. Here a branch strikes off south-eastwards along a river valley and crosses a bridge on to Pamban Island where steamers connect it with the Ceylon railway to Colombo. The main

line runs south from Madura to **Tinnevelly** but, before reaching it, sends off a branch to **Tuticorin.** Leaving Tinnevelly, the main line turns north-westwards, crosses the Western Ghats by a pass and reaches the coast at Quilon in Travancore State. A line now joins Quilon with **Trivandrum,** its capital. Tanjore and Trichinopoly are busy temple towns on the Kaveri delta. The latter is an important railway centre. **Madura** is another temple town and an ancient capital. Like Tanjore and Trichinopoly it has several small industries, such as the making of brass and silver vessels and the weaving of cloth. **Salem** and **Coimbatore,** both on the railway to Calicut, are agricultural centres. **Bellary,** the largest town in the Ceded Districts, is a cotton centre and military station. **Ootacamund,** the finest hill-station in India, lies high up on the grassy Nilgiri Hills close to Dodabetta, their highest peak.

THE STATES AND PROVINCES OF THE TABLE-LAND.

Mysore State.—Looking north from Dodabetta we can see the table-land of Mysore spread before us. This is the highest part of the Table-land of India and is flanked by the Eastern Ghats on the one side and by their big brothers, the Western Ghats, on the other. Mysore, from its height, is the birthplace of rivers. In the south the Kaveri, which rises in the Western Ghats in the small province of Coorg, flows over the table-land, where it is fed by several tributaries, and leaves it by falls (used to generate electricity) on its way down the Eastern Ghats to its delta on the Bay of Bengal. The Tunga and Bhadra, also rising in the western high land, join together to form the Tungabhadra, a large right bank feeder of the Kistna. The Penner flows northwards out of the state and then turns to the east. The Palar and Ponnaiyar flow eastwards.

Bangalore, in the south-east, is the only town with more than a lakh of people. It is an important railway centre. One line runs north to join the main line from Madras to Bombay; another passes north-westwards past Hubli, Dharwar and Belgaum to Poona. A third runs south-westwards to **Mysore**

town, the capital of the state. On its way it crosses the Kaveri at **Seringapatam,** where Tippu Sultan fought his last battle. A fourth strikes eastwards down the Ghats to meet the line to Madras from the west coast. On its way it passes close to **Kolar,** the most important gold-field in India.

FIG. 85.—The thick lines show the boundaries of the Central Provinces and of the Central Indian Agency.

The Central Provinces and Berar.—These lie inland from the Bombay Presidency and occupy the centre of the Table-land of India. Like Mysore, they are the birthplace of rivers. Far in the east the Narbada rises in the Maikal Range and, with the Vindhya Range, forms part of the boundary in the north. The Tapti drains the western part of the Central

Provinces and Berar into the Gulf of Cambay at Surat. The Godavari carries off the drainage of the centre and south. Its left bank feeder, the Penganga, forms the southern boundary of Berar. In the east the Mahanadi and its feeders drain the Chattisgarh plain and in the north several tributaries flow northwards into the Son which enters the Ganges above Patna. The valleys of these rivers are the most fertile parts of the province, growing rice and cotton. In the drier parts the usual millets, pulses and oil-seeds are sown. Wheat is a large winter crop, especially in the valley of the Narbada. In the south-west lies Berar, a broad valley of black soil growing large crops of cotton for local and Bombay mills. The south-eastern part of the Central Provinces is a country of forest-covered hills with but little cultivation.

Towns.—**Nagpur,** the capital, lies nearly half-way along the main line between Bombay and Calcutta. Its mills spin the cotton brought in from neighbouring districts. **Wardha, Hinganghat, Warora** and **Chanda,** in the Wardha Valley, also press and spin cotton. Warora is near a coal-field but its output is only a fraction of the Bihar and Orissa and the Bengal fields. Rich deposits of high-grade manganese ore are mined in the Central Provinces. In Berar the main industry is the ginning, cleaning, pressing, spinning and weaving of cotton, its staple product. **Amraoti** is the centre of this industry. **Jubbulpore,** in the north, is a growing town, being an important railway junction where the East Indian from Allahabad joins the G.I.P. from Bombay. **Raipur,** on the fertile Chattisgarh plain watered by the Mahanadi, is being joined by a railway across the Ghats with Vizagapatam, a seaport on the Bay of Bengal.

Hyderabad State (Fig. 83).—South of the Central Provinces and of Berar lies Hyderabad State or the Nizam's Dominions. It lies within the embrace of two rivers. Starting from the Eastern Ghats, where the Godavari breaks through them, and tracing back that river and its feeder the Penganga, we pass along the north-eastern and northern boundary of the state. Starting again from the Eastern Ghats, where the Kistna

breaks through them, and tracing back that river and its feeder the Tungabhadra, we get the southern boundary separating the state from the Madras Presidency. From Bombay we can reach Hyderabad city, the capital, by the main line to Madras which passes through the south-western corner of the state and sends off a branch line from Wadi junction to the capital; or, we can, on the main line to Allahabad, strike off at Manmad junction by a line which runs south-eastwards through the state. The valleys of the many rivers flowing over this part of the table-land are fertile and grow rice but the rest of the country produces only dry crops such as millets, ragi and oil-seeds. In the north-west the black soil favours the growth of cotton and wheat. There are few industries except the ginning, pressing, spinning and weaving of cotton and some coal-mining at Singareni on the Warangal coal-field.

Towns.—The state has many old capitals built round forts. **Golconda, Gulbarga** and **Bidar** lie to the west of Hyderabad city. Far to the north-west is **Aurangabad,** Malik Ambar's capital, and near it is the old Hindu fort of **Daulatabad. Hyderabad City,** the Nizam's capital, lies in the south centre. It is full of mosques and palaces and has a mixed population. The town has in recent years been much improved and its business is increasing. Close to it is **Secunderabad,** a large military station.

Central India States.—North of the Central Provinces we come to a number of states grouped under the Central India Agency. Here we reach the northern edge of the table-land where the Chambal, Son and other rivers drain it into the Jumna and Ganges. From Khandwa junction, on the main line from Bombay to Allahabad, a railway line runs north, crossing the Narbada and Vindhya Hills, to **Indore,** the capital of the Maharajah Holkar's territories. Near it is **Mhow,** a large military station. Beyond Indore the line passes through **Ujjain,** one of the most sacred of Hindu cities. From Itarsi, a junction farther on than Khandwa, a main line runs north through Jhansi to Muttra and Delhi. On this line we first pass through **Bhopal,** the capital of the Begum, then through

Bilsa, near which is the famous Buddhist tope of Sanchi, then to Jhansi, an important railway junction. Before crossing the Chambal we see the famous rock-fortress of **Gwalior,** a mile and a half long. Gwalior, the largest town in Central India, is the capital of the Maharajah Sindia.

Rajputana.—The line from Khandwa through Indore and Rutlam junction takes us north to Ajmer close to the Aravalli Hills (Fig. 71). This range runs from south-west to north-east up to the outskirts of Delhi and divides Rajputana into two parts. The larger part to the west is dry and gets drier as we leave the mountains and approach the Thar Desert which fills up the western end of Rajputana—about a quarter of the whole of it. In this western part, owing to lack of rain there are no rivers, only scanty crops can be grown and many of the people live as shepherds wandering about with their cattle, sheep and camels in search of pasture, just as happens in other dry parts of the world. The other part of Rajputana, east of the Aravallis, gets more rain and is watered by the Chambal and some feeders. Harvests of millets and oil-seeds are reaped in the autumn and of winter wheat and barley in the spring.

Rajputana is not a province nor a single state but an agency, or group, of eighteen states under the advice of a British agent who resides at **Ajmer,** a walled city on a table-land of the Aravallis and capital of the small British province of Ajmer-Merwara. The capitals of the states are built on sites such as hills or rocky ridges well suited for defence. They are surrounded by high walls and protected by forts containing palaces and gardens. The sons of the chiefs are educated at the Chiefs' College at Ajmer. These towns have but little trade. **Jaipur,** one of the finest cities in India, lies at the foot of hills crowned with forts. Close by is Amber, a deserted town with a fine fort and palace. **Bharatpur** and **Alwar** are two other Rajput capitals in the north-east. **Dholpur,** on the Chambal, is the capital of a Jat state. **Udaipur,** in the south-east, is another fine fortified city with a palace of granite and marble built on the shores of a lake. It is reached by a branch line from Chitor, where there is a

magnificent hill-fort, the ancient capital of Udaipur State. **Jaisalmer, Bikaner** and **Jodhpur** lie out in the west in dry and half-desert country, surrounded by sand-hills growing scanty crops. The people have to dig deep wells for water and even that is brackish. The famous salt-lake of Sambhar lies on the borders of Jodhpur and Jaipur States.

FIG. 85A.—View in Jaipur.

CHAPTER XXXVII.

FRONTIER INDIA.

(See Figs. 71 and 74.)

Baluchistan, the North-West Frontier Province, Kashmir, Nepal, Bhutan.—The north-west frontier of India is the most important of its border lands, as it is the only side on which India is threatened with invasion. **Baluchistan**, separated from the Indus plain by the Sulaiman and Khirthar ranges, forms the eastern part of the table-land of Iran. The Kalat State occupies nearly the whole of the southern half and the northern half is under the control of the Government of India. As Baluchistan is outside of the influence of the monsoon, it is nearly rainless and large parts of it are desert. In consequence the population is very thin, being only about half of that of Bombay city. There are only a few towns. **Quetta,** over 5000 feet above sea-level, lies in a valley among the mountains and is, on account of its position, an important military post, for it guards the northern entrance of the Bolan Pass from Afghanistan. It is, therefore, strongly fortified and is connected by a railway through the pass with Jacobabad on the Indus plain. Its position makes Quetta a place of trade also, for it is the starting-place of caravan routes to Kandahar, South Afghanistan and Persia.

The North-West Frontier Province is a strip of British territory lying west of the Indus and stretching from the Sulaimans in the south to the foot of the Hindu Kush in the north. A small part of it also lies east of the Indus. The whole of this province is a mass of rugged mountains separated by valleys down which rivers find their way to the Indus. Up these valleys trade routes and military roads lead over the

passes which separate the province from Afghanistan. The Kabul, the largest of these rivers, joins the Indus opposite Attock. The road does not follow the valley all the way and is called, not the Kabul route, but the Khyber route from the Khyber Pass through which it goes. **Peshawar,** a large town, lies on this route and is joined by a railway, which bridges the Indus, with Attock. It is the chief garrison town guarding this frontier. **Kohat,** commanding the Kurram Valley, **Bannu,** the Tochi Valley, and **Dera Ismail Khan** the Gomal Valley, are smaller frontier posts and trading places. To Peshawar camels bring raw silk and fruit from Kabul and gold and silver thread from Bokhara. They carry back silk cloth, cotton cloth, sugar, tea and salt.

Kashmir is a part of Frontier India, but it does not border any country from which real danger to India need be feared. It is an Indian state under the protection of the Government of India like any other. The map shows it is filled with lofty snow-capped mountain ranges separated by many small valleys and one broad one, the Vale of Kashmir. The outline of Kashmir is like a rough square fitted on to the northern border of the Punjab. The Indus, flowing north-west, and its feeder, the Gilgit, flowing south-east, divide this square like a diagonal. The northern half is a mass of mountains running in ranges parallel to this diagonal. In no country in the world, except perhaps Peru, are there such magnificent masses of snow-covered peaks. The Karakoram Pass, leading into Eastern Turkestan, is over 18,000 feet above sea-level—four or five times the height of the Western Ghats—and Mount Godwin Austen, the loftiest summit of the Karakoram range, is next in height to Mount Everest. The southern half is filled with roughly parallel Himalayan ranges. The Vale of Kashmir (5000 feet), through which flow the Jhelam and its canals, is the only large stretch of flat and cultivated land in the state. In winter it is covered deep with snow. Being surrounded by snow-covered mountains, it is one of the most beautiful regions of the world. In it lie two fresh-water lakes which add to its beauty. It produces crops of wheat, barley, pulses and the

fruits of temperate climates such as apples, peaches and grapes. The chief town, **Srinagar,** stands on the Jhelam close to the Wular Lake. Its position makes it the centre of trade-routes over the mountains and into the Indus plain in the south. **Leh,** far up the Indus Valley, is the starting-place of a trade route across the Karakoram Pass. **Gilgit,** in the Gilgit Valley, commands the passes to the north over the Hindu Kush.

Nepal and Bhutan.—These states occupy the eastern half of the Himalayan high land and separate India from Tibet. They are independent but under the protection of the Indian Government against interference by foreign powers. Nepal is entirely filled by mountains separated by valleys along which rivers flow into the plains to feed the Ganges. Mount Everest (29,000 feet), the highest mountain in the world, lies on the borders of Nepal and Tibet; Dhaulagiri and Kinchinjunga, are two of its biggest brothers. In the valleys rice, millets and oil-seeds are grown, and there are fine timber forests on their slopes. Nepal exchanges its crops for cotton goods, salt, sugar and metals sent up from the plains. **Khatmandu** is the capital. Bhutan is very like Nepal, a land of forested mountains and deep valleys, but it is a much smaller state. Between Nepal and Bhutan lies the small protected state of Sikkim. The Chumbi Valley, belonging to Tibet, lies between Sikkim and Bhutan, and through it passes a trade-route leading across the mountains from India to Tibet and on to Lhasa, its capital.

CHAPTER XXXVIII.

INDIA BEYOND THE BAY—BURMA.

THOUGH Burma is outside of India proper and its people are of a different race and religion from those of India, yet it forms part of the Indian Empire under the Government of India like any other province. A voyage of about three days in a good steamer, eastwards from Madras or south-eastwards from Calcutta, brings us past Cape Negrais to the delta of the Irrawaddy. Helped by the tide, we can sail for some 80 miles up the most westerly distributary to Bassein, or up the Rangoon estuary to Rangoon which is connected with the main river by a navigable creek. Instead of doing so, we might continue our voyage eastwards to Moulmein, a seaport near the mouth of the Salween. From Rangoon or Bassein a flat-bottomed river-steamer could take us up the Irrawaddy for hundreds of miles past many small river-ports and villages to Mandalay and beyond it to Bhamo. Instead of going by river, we could travel by train from Rangoon past the old town of Pegu straight northwards to Mandalay. From this junction a train (and a ferry across the Irrawaddy) would carry us along other valleys as far as Myitkyina, away to the north in the midst of wild and little-known country. Another line from Mandalay strikes eastwards to the Salween very close to the borders of China.

Build.—The map shows that Burma is made up of the basin of the Irrawaddy and of a strip of coast fringed with islands stretching half-way down the Malay Peninsula. The northern half is the Arakan coast and the southern half the Tenasserim coast. The map also shows that Burma is a country of

FIG. 86.—The thick lines show the boundaries of Burma.

mountains and river-valleys, of which that of the Irrawaddy is much the largest. The northern part of it is filled with mountains running in parallel ranges north and south. Towards the south these ranges open out and form the Arakan Yomas, the Pegu Yomas and the Shan Hills; while the Siam Mts., under the name of the Tenasserim Yomas, run along the coast south of Moulmein.

Climate.—The northern limit of the province is in the latitude of Delhi, and Cape Victoria* is as far south as Madura. Only the thinly peopled parts of the far north are outside the tropics. Burma has thus a hot climate. The coast-strips, *i.e.* the Arakan coast, the Irrawaddy delta and the Tenasserim coast, receive the full force of the summer monsoon which is dashed on the mountains behind them. The rainfall here is, therefore, as heavy as on the west coast of India. The rest of Burma is also wet (receiving more rain than most parts of India) except in a small area round Mandalay in the centre, lying under the screen of the Arakan Yomas, where the rainfall is not more than in the drier parts of the Deccan.

Vegetation.—As in Bengal, the heat and heavy rainfall are well suited to the growth of paddy, and this is much the most important crop and is largely exported. On the hills, which also receive heavy rain, almost every kind of timber known in India, especially teak, grows wild in the dense forests. In the drier area, as in the Deccan, maize, millets, wheat and pulses are the chief food-crops. Large crops of tobacco are also grown, for all Burmans smoke.

The Rivers.—Burma is a country of mountains and valleys, along which rivers flow southwards. The Irrawaddy is much the most important. Most of the people live on, or near, its delta and its banks, and along it is carried a great deal of trade. The river is very suitable for navigation for it receives a plentiful supply of rain. Even in the dry season it is a quarter of a mile wide up to Mandalay. In the monsoon season its breadth is doubled and its depth trebled. Mandalay, some 600 miles from the sea, is only 250 feet above sea-level, which

*Called, in Burma, Victoria Point.

shows how flat the course of the river is. Steamers can go up it beyond Bhamo, a distance of 900 miles from the sea, and its tributary, the Chindwin, is navigable for 300 miles. The Salween, though a much longer river, is not nearly so useful, because it flows in a narrow valley among mountains and over a rocky bed so that it is only navigable for a few miles above its mouth. The Sittang, a much smaller river, is often blocked

FIG. 87.—Teak-built boats on the Irrawaddy.

by sandbanks and is of little use for navigation except in the floods of the monsoon.

The People.—Burma lies in the south-west corner of the great Mongolian region of the world, and the people are Mongolians except for a few people of Dravidian blood who have immigrated from India. Burmese, unlike the Sanskritic and Dravidian tongues of India, is one of the Indo-Chinese family of languages. The people are almost all Buddhists. Monasteries and pagodas are seen in every town and village. Many Indians and Chinese have made their homes in Burma as merchants, shopkeepers and craftsmen. On the mountains

very few people live. Most of the towns and villages are on the banks of the rivers.

Towns.—**Rangoon,** the capital, is much the most important town. Owing to its position at the head of an estuary up which ocean steamers can come, it is the sea-outlet of the fertile delta and basin of the Irrawaddy. Down this river are brought the

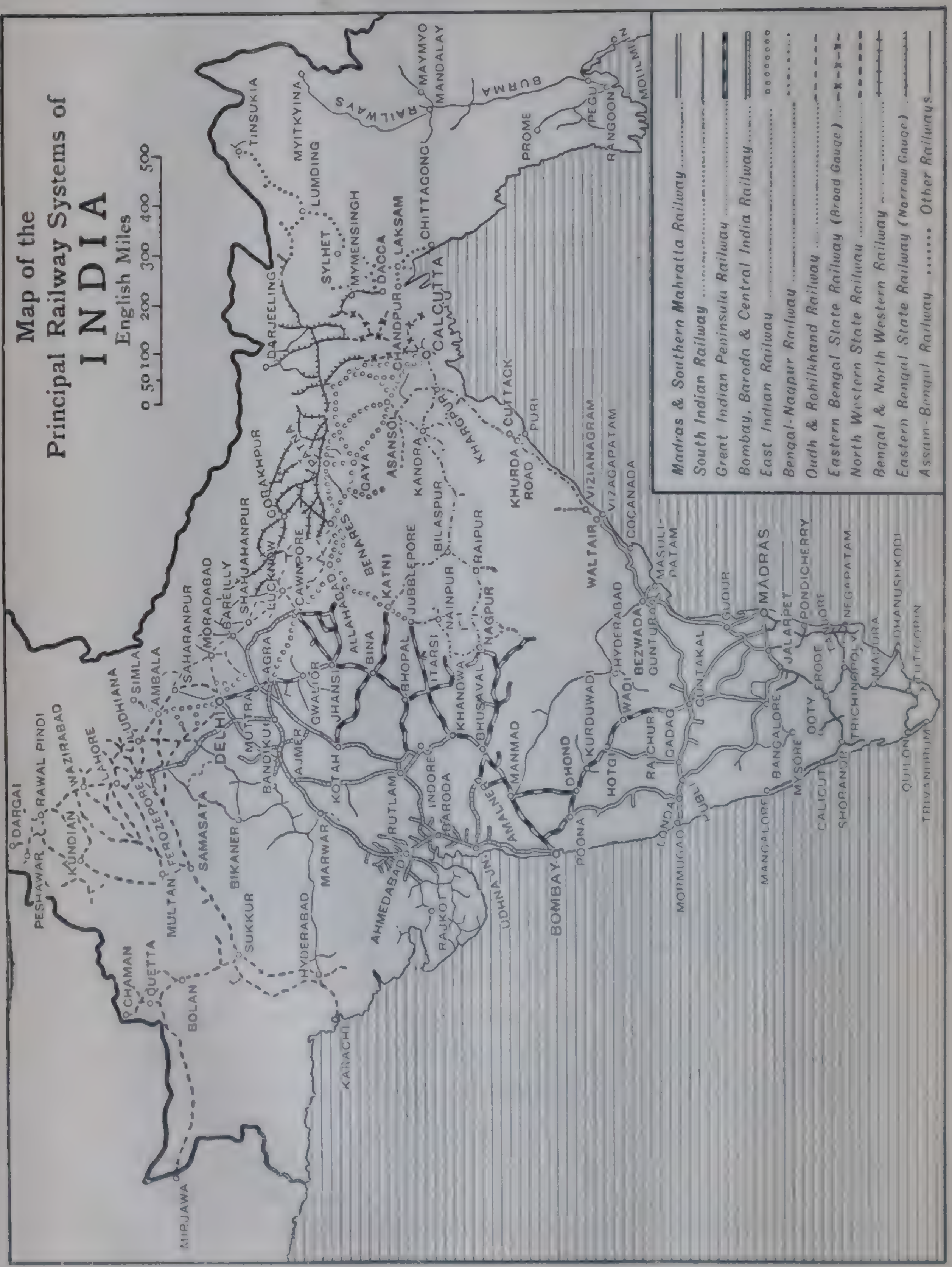
FIG. 88.—A Pagoda in Rangoon.

rice grown on its delta and valley, the oil pumped out of hundreds of wells at Yenangyaung, far up the river, and the teak floated down in huge rafts from the mountain forests. These three products give birth to the chief industries of Rangoon. The rice is husked and cleaned, the oil is refined into petrol and petroleum and made into candles, and the teak and other timber is sawn into planks. Up the river from Rangoon are taken the manufactured goods brought to its

harbour from foreign countries. It is also the starting-place of the railways. The main line passes through Pegu and up the Sittang Valley to Mandalay, from which centre other lines branch off to the north and east. From **Pegu** a branch line running east joins it with Moulmein. Nearly all the foreign trade of the country passes through Rangoon.

The other towns are either seaports or river-ports. At **Moulmein** mills saw up the teak-logs floated down the Salween and other monsoon-fed rivers and husk the rice grown on the flat coast-lands. A railway is being made southwards to join it with **Tavoy,** a tin-exporting port. **Bassein** is a delta-port some 80 miles up from the sea, exporting the rice of the delta in ocean steamers. **Akyab,** near the mouth of a navigable river on the Arakan coast, exports the rice grown on the fertile coast-strip and the teak grown on the Yomas behind it. We might compare it with Calicut or Mangalore. **Mandalay,** the only town with more than a lakh of people except Rangoon, is a busy river-port and a railway centre. It is famous for its palaces, monasteries and pagodas, and near it are old capitals such as Ava, Sagaing and Amarapura. Sailing down the river we pass many river-ports where the steamers put in to take up and set down cargo. **Pakokku,** near the meeting-place of the Chindwin with the main river, collects the timber logs brought down on this feeder. **Prome,** much farther down, is connected with Rangoon by a railway. Two days' voyage up the river from Mandalay brings us to **Bhamo.** Here we see hundreds of ponies which have brought goods from China to be sent down the river. On their way back they take manufactured goods brought up from Rangoon.

The Islands of Burma.—Off the Arakan coast lie a few volcanic islands and off the Tenasserim coast lies the Mergui Archipelago, a group of hundreds of islets covered with forest. Extending south of Cape Negrais is a line of islands which are believed to be the tops of a sunken range of mountains. The Andamans and Nicobars are two groups. **Port Blair** is on the South Island of the Andaman group. Though geographically belonging to Burma, they are administered by a Chief Commissioner under the Viceroy.


Map of the
Principal Railway Systems of
INDIA
English Miles
0 50 100 200 300 400 500
Madras & Southern Mahratta Railway
South Indian Railway
Great Indian Peninsula Railway
Bombay, Baroda & Central India Railway
East Indian Railway
Bengal-Nagpur Railway
Oudh & Rohilkhand Railway
Eastern Bengal State Railway (Broad Gauge)
North Western State Railway
Bengal & North Western Railway
Eastern Bengal State Railway (Narrow Gauge)
Assam-Bengal Railway
Other Railways
Emery Walker Ltd. sc.

CHAPTER XXXIX.

CEYLON.

THE island of Ceylon, lying to the south-east of tne peninsula of India, is not a part of the Indian Empire, but is a colony ruled by a Governor and a Council in the name of the King-Emperor. It is shaped something like a mango and its area is a little less than that of Mysore State. The flat, low-lying coasts gradually slope up to a central core of mountains straight inland from Colombo, the highest peaks of which (Mount Pedro and Adam's Peak) are higher than the Western Ghats. Its coasts, like those of India, are very regular but along the sea-shore there are many backwaters or lagoons like those of Malabar, and in the extreme north the low peninsula of Jaffna is connected with the mainland by a very narrow neck of land.

Climate.—Ceylon is a tropical island and, as it is so near the equator, there is very little difference between the hot and cool season. As it lies in the track of both monsoons, it receives plenty of rain and most parts of the low lands are fertile. The rivers are too short to be of much use for navigation except by boats and rafts.

Vegetation.—Round the coasts are groves of coco-nut palms which thrive well on the salt, sandy soil. Farther inland there are wide stretches of paddy-fields watered by streams coming from the mountains. The slopes of the mountains are covered with forests but many of these have been cleared to make room for tea plantations. Ceylon exports large quantities of this tea. In the lower wet lands there are many plantations of rubber which is also an important export.

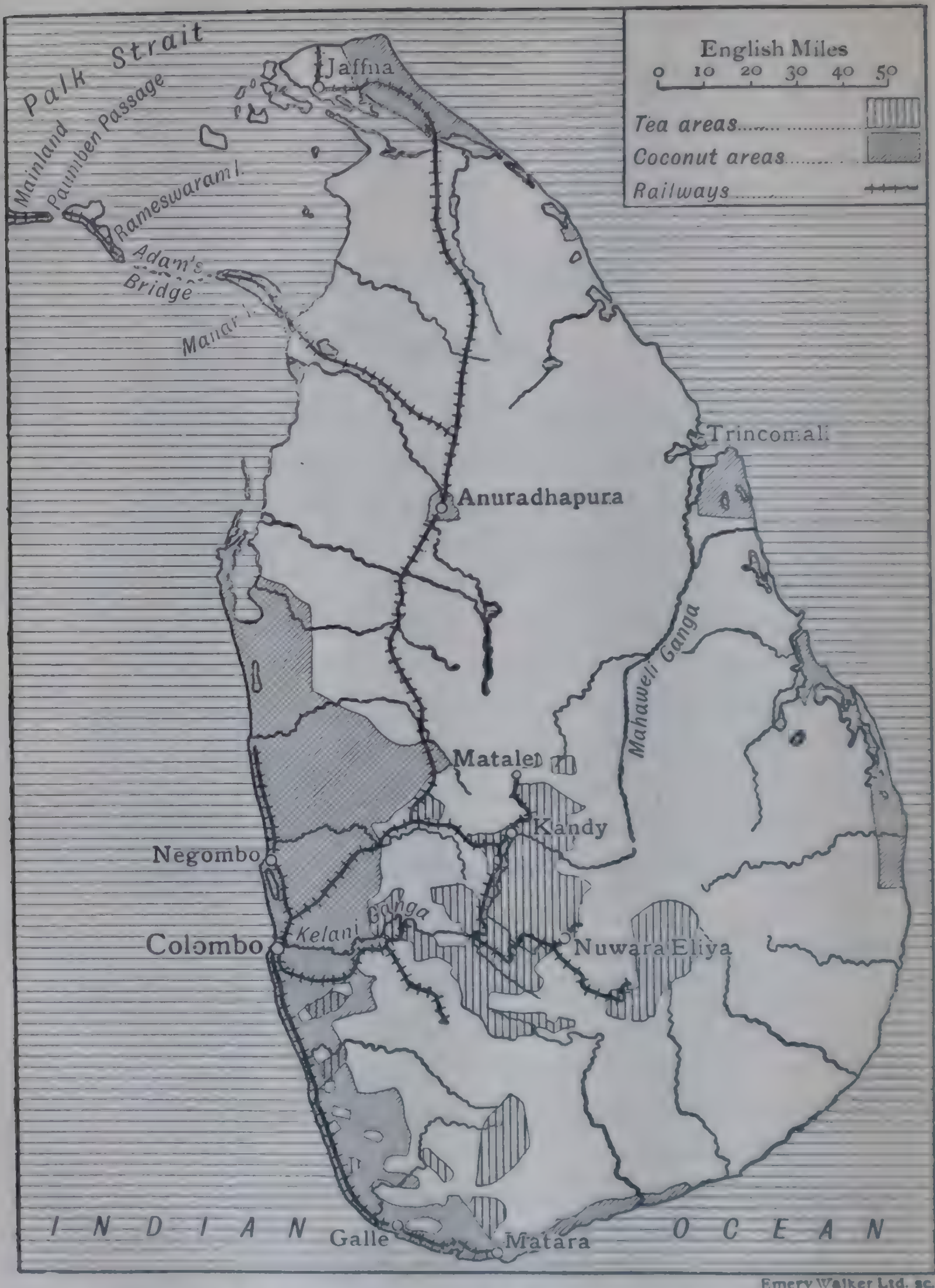


FIG. 90.—Tea and coco-nut areas of Ceylon. Rice is grown in the low-lying lands.

Towns. Much the largest town is **Colombo** on the west coast. It owes its importance to its fine harbour which is formed by long breakwaters which give a deep-water shelter

for ocean vessels. Through it nearly all the sea-trade of the island passes. Its position also makes it one of the most important harbours in the world. The map of Asia shows it is the

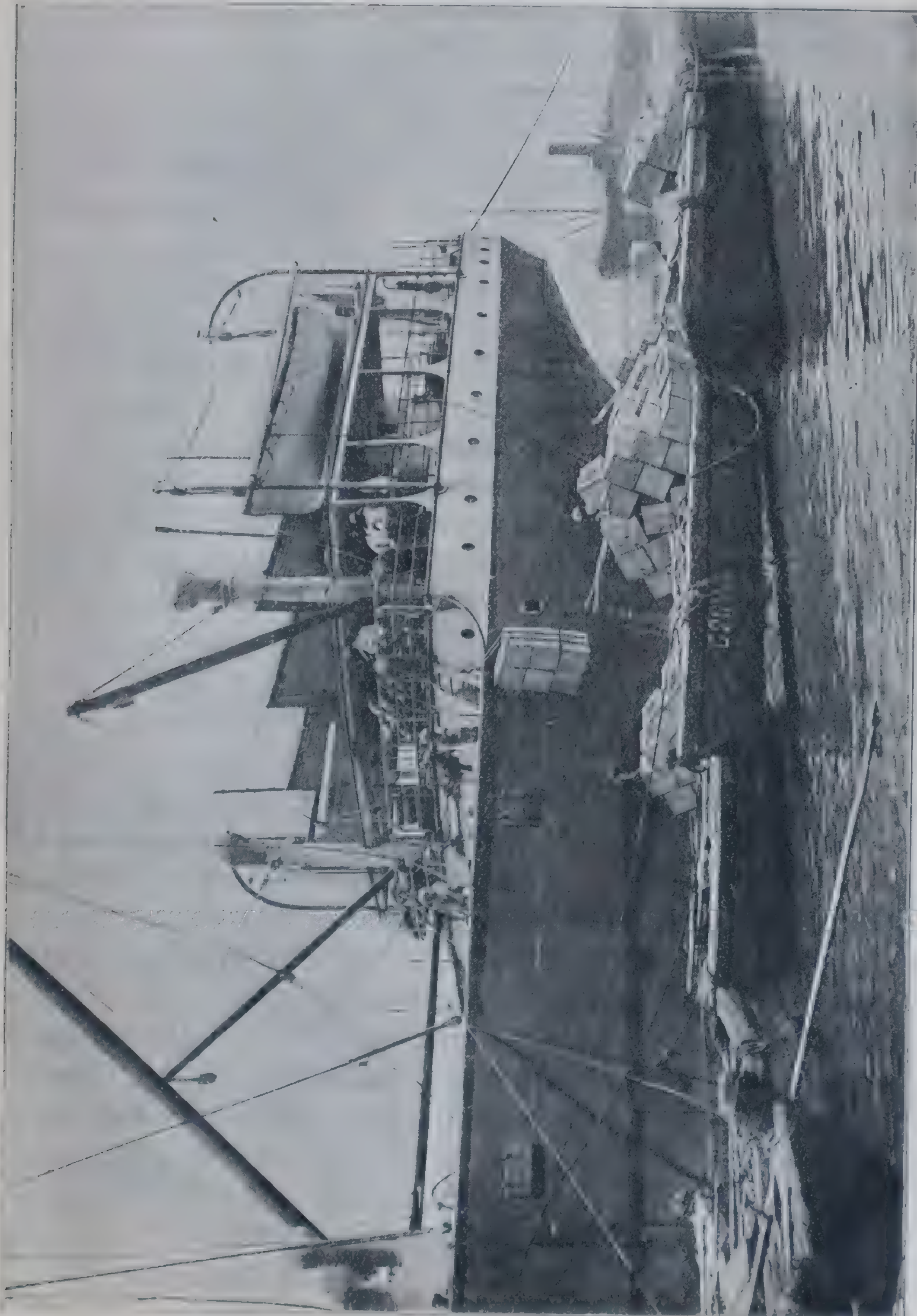


FIG. 91.—Loading chests of tea in Colombo harbour.

meeting-place of ocean-routes from Europe, Asia, Africa and Australia. We might call it the half-way house between east and west. In its harbour vessels from all parts of the world meet. All these vessels do not come here for the sake of trade, because Ceylon has not very much to export except tea, coco-nuts and rubber. They come to buy coal for their engines ; in Colombo harbour there are great heaps of coal which has been brought from England, and Ceylon is one of the chief coaling-places in the world. Colombo is also the meeting-place of the railways of the island. One line running south along the coast brings us past fishing villages to the seaport of **Galle,** which used to be visited by ocean vessels before the harbour at Colombo was built. Another line climbs the central high land to **Kandy,** an ancient capital, famous for its botanical gardens, among the most beautiful in the world. Climbing higher the train takes us past Adam's Peak to **Nuwara Eliya,** a hill station at the foot of Mount Pedro. Instead of going as far as Kandy we could strike northwards past Anuradhapura to **Jaffna** or north-westwards to Manar. **Anuradhapura** is one of the wonders of Ceylon. It is called a buried city, for here, in the midst of forests, are the ruins of Buddhist pagodas, monasteries and bathing tanks where thousands of people used to live. It is now quite deserted. At Manar we can take the ferry steamer, which in an hour or two reaches Pamban Island where the train for Madras is waiting. A night's voyage from Colombo would take us to Tuticorin on the opposite shore of the Madras Presidency. **Trincomali** has a large, deep, natural harbour but, unlike Colombo, it is off the track of sea-routes. A line is being made to join it with the railways of the island.

The **Sinhalese,** who form by far the largest part of the population, speak a Sanscritic language and are Buddhists. There are also many Tamil speakers who have migrated from Southern India. Formerly they came as conquerors and settlers to the north part of the island. At the present day they come across to work on the tea and rubber plantations.

CHAPTER XL.

THE MONSOON LANDS OF ASIA.

THESE lands are India, Ceylon, Burma, the Indo-Chinese Peninsula, China (proper) and Korea. This is called the Monsoon Region because it is watered by the heavy rain of the monsoons at regular periods of the year. It receives far more rain than the rest of Asia. The summer monsoon, as we know, blows in June, July, August and September. It brings rain to the whole of this region, just as it does to India, and goes far inland. The rainfall is heaviest near the sea, and at places where the monsoon wind strikes against ranges of mountains. The winter monsoon blows in October, November and December. It comes from the north-east and brings rain to eastern China, and the south-eastern shore of India and Ceylon. But in northern China it is a cold dry north-west wind. When the monsoons change, violent storms take place. In India and Burma we call these storms cyclones. In China and on the Pacific Coast they are called typhoons. These storms bring heavy rain and cause great destruction. These monsoon lands, besides receiving much rain, receive much heat. They are, therefore, very fertile. The soil, climate and plants of the monsoon region are very like those of our own country. As the monsoon lands are so fertile, we can understand they are densely populated. They contain more than half the people of the whole world.

India, Burma and Ceylon we have already studied.

Indo-China : Map Study.—Indo-China really consists of two peninsulas—the narrow Malay Peninsula running far south and almost touching the equator, and the broad Indo-China

peninsula farther east. Its coast-line is thus much broken, and being mountainous, it receives much rain from the monsoon. Its chief rivers are the Menam, the Mekong and the Song-ka or Red River flowing into the Gulf of Tonking. The

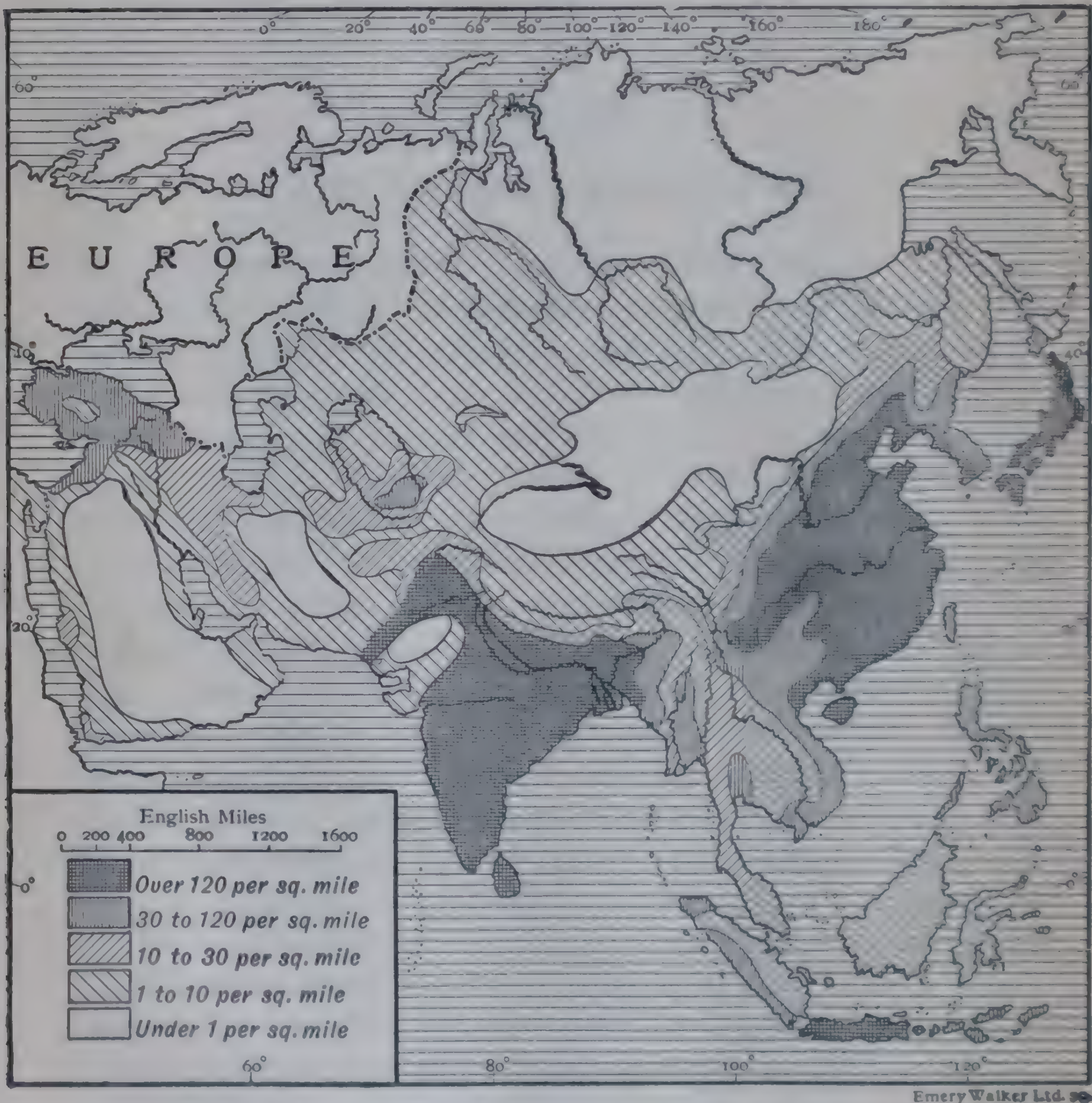


FIG. 92.—Asia—Density of Population. (Compare with rainfall map.)

mountains in the north part of Indo-China catch the monsoon rains and these fill the rivers. The map shows Indo-China is made up of river valleys, fed by monsoon rains, just like the Irrawaddy, the Ganges and the Brahmaputra. The large rivers have many tributaries, just as ours have. There are, besides,

FIG. 93.—Further India and the East Indies. (Note the position of the Equator.)

many small rivers flowing into the sea. Just like the Ganges, the rivers of Indo-China bring down from the mountains much mud and sand, spread it over their flat valleys, and throw it into the sea to form deltas. They are also, like our rivers, much used as highways for boat traffic up-country from the coast. In the rainy season they float down great rafts of timber from the forest-covered hills far inland.

Crops.—We can be sure that the crops of Indo-China will be very much the same as those of India. Rice is the chief crop, and flourishes well in the deltas and river valleys. Large harvests of cotton, indigo and sugar-cane are also reaped; spices such as cinnamon, pepper and ginger, are very plentiful. The fruits are like our own, such as jak fruits, mangoes, plantains, lemons, oranges and pine-apples. The coco-nut palm loves a flat sea-coast with plenty of rain, and groves of it are found all along the shores of the peninsulas. Away from the deltas and sea-shores, among the hills and mountains are vast monsoon-fed forests like those of the Western Ghats, which have scarcely been trodden by the foot of man. They are full of teak, india-rubber trees, palms, bamboos and dye-woods. Elephants drag the logs to the rivers down which they are floated. The people of the Indo-Chinese peninsula are, like those of India and Burma, mostly agriculturists. But Indo-China, unlike India, has not been civilised for hundreds and thousands of years. Till quite recently wars, murders and dacoities were quite common. The population is not therefore nearly so dense as in India, and there are very few large towns.

Towns.—These are all on the coast, some on deltas where the trade of the rivers meet the trade of foreign countries coming oversea. A few railways run inland from the coast, and far from the sea there are only villages. The thick end of the Malay Peninsula comprises the **Straits Settlements**, a part of the Empire. **Penang,** an island at the northern entrance to the straits, has an important harbour which carries on a large trade with India and other countries. It collects the tin dug up from the mines of the peninsula, and the pepper and spices, the rubber, gutta-percha, gum and copra grown on the

coast. It is now connected by a railway running up the peninsula with Bangkok, and by another running south to Singapore. Much the most important town and seaport is **Singapore**, on another island at the end of the peninsula. It has no fertile delta or river valley behind it, and so depends for its importance on its position on the sea-gateway that joins two great oceans. Sea-trade has made Singapore one of the busiest harbours in the world. Here meet steamers from Europe, India, China, Japan and Australia. Small vessels from the coasts of Indo-China and the fertile islands to the south and east bring cargoes of tin, rubber, spices, copra, rattan canes, hides and skins. These are transhipped into the larger ocean-vessels, and taken to all parts of the world. The small vessels take back foreign goods such as cotton cloth and yarn (some of it from India) iron goods and machinery from Europe. Chinese do most of the local trade. Singapore is, besides, an important coaling station for vessels. Singapore island, like that of Bombay, is now joined by a bund to the mainland.

Bangkok, the capital and chief seaport of the independent state of **Siam,** stands some distance up the river, on the delta of the Menam. It is, like Calcutta and Rangoon, the centre of a large up-river and over-sea trade. Most of the inhabitants live in a floating town of boats on the river. The city is intersected by canals which serve as roads. The houses are built on rafts moored to piles so that they rise and fall with the tide. Many of these floating rafts are used as shops. Bangkok in its trade is very like other seaports of this monsoon region. On the delta and coast lands rice fields are everywhere. Behind them are fields of sugar, tobacco and cotton. Groves of coconut and areca-nut palms are plentiful. If we go inland to the hills, we see forests of teak and other timber trees. Bangkok mills clean and grind the rice which is largely exported. Teak logs are floated down the river.

French Indo-China.—The eastern part of the Indo-China peninsula, bordering the Gulf of Siam and the South China Sea, is under French rule. It produces the same crops as other parts of this monsoon region. **Saigon** lies at some distance from the

sea, on a river which flows across part of the great delta of the Mekong. It husks and exports rice. **Hué**, the chief town of the Annam province, is another port exporting rice from the wet flat paddy lands near it. The capital of French Indo-China

By courtesy of the F M S Devt. Agency.

FIG. 93A.—Preparation of Rattans in Malacca.

The canes are being straightened by bending round posts. Note the bundle of canes in the centre of figure.

is **Hanoi** on the Song-ka, or Red River, flowing into the Gulf of Tongking. Its harbour is **Haiphong.** All the seaports of this peninsula, Rangoon, Penang, Singapore, Bangkok, Saigon, Hué and Haiphon export rice and other products of the monsoon lands. The second and third of these are island-ports: the others are river-ports as well as seaports.

CHAPTER XLI.

MONSOON LANDS (Continued).

(See coloured map of Asia and Fig. 64).

China : Map Study.—The outline of China proper is roughly a circle. The meridian of 100° E. might be called a tangent to this circle on the west, and the Tropic of Cancer cuts off a small segment in the south. On the east the coast bulges out in a semi-circle to the South China, East China and Yellow Seas which form part of the Pacific Ocean. The coast-line, unlike that of India, is broken into many small inlets and islands so that there are plenty of suitable places for harbours. In the north the Pechili Gulf is almost enclosed by the two jaw-like peninsulas of Shantung and Liaotung. In the south, the Gulf of Tongking is partly formed by the island of Hainan. The western side of the circle stretches up into the lofty table-land of Tibet. A political map shows that on the land side the circle touches, in order, French Cochin-China, Burma, Tibet, Mongolia and Manchuria. The last three of these countries form part of the Chinese Empire, but at present we are only studying China proper. The physical map shows the western half of the circle is almost filled with high land which in the extreme west forms part of the high Tibet table-land. The south-eastern quarter of the circle is a country of mountain ranges, hills and river valleys, but these mountains are much lower than those in the west. In the north-east quarter, or quadrant, of the circle it is different. Here the mountains stop short of the sea and a long, broad flat plain, the Great Plain of China, borders the Yellow Sea and Pechili Gulf, and encloses the hilly and rocky peninsula of Shantung.

The best way, however, to understand the geography of China is to trace the course of its three great rivers, the Si-kiang or Canton River in the south, the mighty Yangtse-Kiang in the middle, and the Hwang-ho or Yellow River in the north. They all rise in the high land to the west and flow nearly due

Photo. E.N.A.

FIG. 94.—The Yangtse-Kiang flowing through the mountains of China.

eastwards across the country. China is a monsoon land, and these rivers and their many tributaries are fed by the heavy rain blown on the mountains from the Pacific, and by the melting snows of the highest ranges. They therefore come down in great floods and carry an immense quantity of water. The rich mud they bear fertilises their valleys on which large crops are grown, and they are much used by boats, junks and small steamers. The Chinese make more use of their rivers than any other people, for there are very few good roads and only one or two railways. China is thus a land of rivers flowing in valleys among hills and along flat plains. On their banks are many towns and river-ports, and hundreds of villages. Almost every town and village in China carries on boat traffic. The Chinese are hard-working farmers, careful gardeners, and skilled boatmen.

The Si-kiang rises in the high table-land of Yunnan (twice as high as the Deccan), which is an easterly extension of the table-land of Tibet. The chief town on this table-land is **Yunnan**, the centre of a poppy-growing district. From this town a trade route crosses hills and valleys to Bhamo, on the Irrawaddy, from which river-steamers run down the river to Rangoon. Some of this trade also goes down the Song-ka, or Red River, valley to the French capital of Hanoi and its port Haiphong, and a railway down this valley joins Yunnan and these towns. This railway carries a good deal of tin to the coast. The third route is down the Si-kiang River to its port of Canton. By it Yunnan opium reaches the rest of China.

Photo. E.N.A.

FIG. 95.—Canton harbour in China.

This river is 1000 miles long and is navigable by boats all the way. Its valley is covered with rice-fields and on its banks are hundreds of villages. Near these the valley becomes wider and merges into the coast plain, a fertile region growing rice, sugar, indigo, tobacco and tropical fruits. On or near the edge of this plain are three important sea-ports—**Canton,**

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Hong-kong and **Swatow.** **Canton** is the sea-gate and market of the fertile valley of the Si-kiang, and is the meeting-place of many water-channels crowded with boats. Many thousands of people live on floating houses. This part of China is just

Photo. Underwood and Underwood.

FIG. 96.—The crowded town life of Canton, China.
(The boats are used both as houses and as carriers of merchandise.)

within the Tropics and is hotter than the north of China, so that rice is the main crop. A Chinaman is not happy without rice and prefers to live within reach of paddy-fields. We might compare the position of Canton, as the sea-outlet of a rich tropical delta, with that of Calcutta. But it has the disadvantage that large ocean vessels cannot reach it but must anchor

several miles down the river. Nor is it nearly so well connected with the interior by railway. One of the few main lines of China, crossing the southern hills and the northern plains runs from it through Hankow to Pekin in the far north. Calcutta, on the other hand, is connected by rail with all parts of the fertile valley behind it. The real outlet and chief seaport of southern China is the deep, protected anchorage of **Hong-kong** (which is part of the Empire), a small island at the mouth of the river. Hong-kong is one of the chief seaports of the world. Here ocean-going vessels call to pick up and leave cargo which has come from, and is going to, Canton and many other smaller seaports of the coast. It is thus a very important gathering and distributing centre for the sea-trade of the east, exporting raw and manufactured silk (which is China's chief export), tea, raw cotton, hides and beans, and importing cotton goods, metals, machinery and other manufactured goods. We can compare its island-harbour with Bombay.

The Yangtse Kiang.—The huge basin of this river is the most important part of China, and is one of the most fertile and most densely peopled parts of the world. The river flows nearly due east across China and its long valley and those of its many tributaries produce large crops of rice while the hill-slopes of these valleys grow mulberry trees (on the leaves of which silk-worms are fed) and the finest tea. We may truly say the Yangtse is, for man, the most important river in the world. It is not nearly so large as the Amazon, but the Amazon flows through dense, damp forests where man cannot live. It is not so long as the Nile, but for hundreds of miles the Nile flows through a desert where it receives no tributaries. The Yangtse Kiang with its feeders is the world's most important river highway. Large steamers can go up it for nearly 700 miles to Hankow (it is as if Benares were a great seaport for large vessels); small steamers can use it and its feeders for many hundreds of miles more, and its junk, boat and raft traffic is far greater than that of the Ganges, Brahmaputra and Irrawaddy combined. At Ichang, 1000 miles from its mouth, there is a gorge which stops steamer traffic, but above

Photo. Exclusive News Agency.

Fig. 97.—Part of Hong Kong harbour.

this gorge the river again becomes navigable for smaller vessels. In its course through the plains the Yangtse Kiang is connected with several lakes and these prevent the river becoming suddenly flooded. It would take pages of this book to name and describe the main river-ports and towns on its banks. We can only mention a few. More than half-way down its course,

FIG. 98.—The Yangtse Kiang river flowing across the plains of China.

on a broad part of its fertile valley, stands the great river-port of **Hankow**. Its position is the best for trade in the interior of China. We might compare it with Patna, for several navigable feeders join the main river near it. The chief of these is the Han, draining a fertile valley from the north-west. The town is the centre of the tea-trade of China; boat-loads are sent down the river for export to Russia and other countries.

Two other river-ports, **Wuchang** and **Hanyang**, lie close to it, and the three towns have as large a population as Calcutta, Bombay and Madras. Hankow, too, is situated in the centre of China just where the main railway running north and south crosses the main waterway flowing from west to east.

Two hundred miles from the sea the great river enters a wide, flat and fertile plain, crossed by rivers and canals and covered with rice-fields. Here stands **Nangking,** an ancient capital. Close to it the Grand Canal meets the river and joins it with the Hoang-ho, some 600 miles farther north across the level plain. **Shanghai** is the great seaport of the Yangtse river-basin, collecting cargoes sent down the river and from ports along the coast and shipping them on ocean steamers which call for them. We might call it the Calcutta of China. Like Calcutta and Rangoon it does not stand on the main river, where the floods would destroy a harbour, but on a creek. Like Calcutta, too, it has many mills, but they spin and weave, not jute, but cotton. Shipbuilding is also carried on. Nearly the whole sea-trade of China passes through the ports of Shanghai and Hong-kong.

The Hwang-ho, or Yellow River, also rises in the lofty table-land of Tibet, but the map shows it takes a great bend, first north and then south, through the desert of Mongolia before it reaches the Great Plain. For a great part of its course it passes through a country unlike any other in the world,* for it is covered with a deposit of dust or mud called loess, many hundreds of feet deep, which has been blown in and heaped up by the stormy winds that carry it from the upland steppes of Mongolia in the west. Even as far east as the Japan Islands the air is sometimes full of this dust. Through this covering of loess the Hwang-ho has cut deep ravines down to the rock of its bed and swept away millions of tons of it, which it is constantly spreading over the plain to the east and pouring into the sea. This yellow mud gives the river its name. Loess is exceedingly fertile soil. Leaving the hills and mountains, the Hwang-ho enters and crosses the Great Plain of China. This plain was once a shallow gulf which has been

* See p. 163.

FIG. 99.—Coming down from the North. Chinese method of transport.

filled up and levelled by the river and its hundreds of feeders and distributaries (just as rivers have built up the Indo-Gangetic Plain), and by the loess dust blown on to it by the west winds. It is being gradually extended into the sea, making it shallower and more difficult for large vessels to navigate. At its edge rises the hilly peninsula of Shantung. This was once an island, but the river for hundreds of years has been filling up the shallow strait behind and has at last joined the island to the mainland, so that it is now a high rocky peninsula. The plain behind is so flat that the Yellow River has flowed sometimes to the north, as it does at present, and sometimes to the south. For hundreds of years the Chinese have built bunds along its banks without taking care to dredge out its bed, so that the level of the river is high above that of the surrounding plain. In consequence, when floods break these banks, the water of the river rushes over the level plain, sweeping away villages and drowning thousands of people. In 1887 the river changed its course, flowed into the Yellow Sea and destroyed ten lakhs of lives. In 1889 it was brought back to its old course by which it enters the Pechili Gulf. Unfortunately the Yellow River, unlike the Yangtse Kiang, is of but little use for navigation as its waters spread over a wide bed and flow to the sea in a swift current.

The northern part of China is not a rice-growing land. The climate is too cold, for here we are farther north than the utmost boundary of Kashmir and cold winds blow over it from the table-lands of the west. The chief food of the people is wheat, millets and barley. Cotton, hemp and some tobacco are also grown in sheltered valleys. In the basin of the Yellow River there are many towns, river-ports and seaports, for the population is dense. We need only remember two of the most important. **Pekin,** the capital of China for over 500 years, lies on the Peiho River flowing from the table-land across the plain into the head of the Pechili Gulf. Its position should be remembered, for it lies on a plain between the mountains and the sea, and commands the route by which caravans of camels climb by passes into the high table-land of Mongolia. It also

commands the route along the coastal plain which leads into Manchuria. Pekin is joined, both by the Peiho River and a railway, with its port of **Tientsin**, which is the chief trade outlet of northern China. From Tientsin one railway runs north and eastwards along the coast to join the trans-Siberian line at Harbin in Manchuria, and another goes southwards across the

Photo. E.N.A.

FIG. 100.—A street in Pekin, the Capital of China.

Great Plain to Nanking on the Yangtse Kiang, and then on to Shanghai. From Pekin itself the main line of China runs south over the Great Plain to Hankow on the Yangtse Kiang, and then by valleys across the southern hills to Canton.

It must be remembered we have only learned a few of the most important towns of China. There are many more, for the country is very densely populated. The Chinese Post Office Guide gives a list of 40 seaports and river-ports with an average of over a lakh of people in each. But the names of most of these are unknown to people outside of China.

India and China compared.—We can compare China with India. In some ways they are like each other; in some ways they are not. Both countries lie between the high table-land of Tibet and the sea. This table-land and the mountains on it are the birthplace of great rivers which fertilise the plains across which they flow. Therefore the plains of India and of China yield large crops and are very densely populated. Both are monsoon countries with a good rainfall. In India the monsoon clouds come from the Indian Ocean; in China they are swept in from the Pacific. In both countries most of the people live by agriculture, and there are but few manufactures. Once more, India and China have both, more than once, been invaded by armies coming from the high lands behind them. These invaders conquered most of the country, but they intermarried with the people and taught them their language and religion.

But there are differences also. In India the Tibetan table-land is fenced off by a long, high and impassable barrier of mountains which rise steeply from the plains. In China this table-land does not stop suddenly. It sends out lower ranges towards the coast which fill up nearly three-quarters of the country. India nowhere reaches the table-land of Tibet. China stretches back into it. In India most of the rivers of the Deccan are unconnected with the three great rivers of the north. In China the three great rivers flow right across the country and gather up the drainage of the whole of China. Almost every river is a feeder of the Hwang-ho, Yangtse Kiang or Si-kiang. Thus there is a better system of river navigation in China than in India. Again, though the coast-line of China is much shorter than that of India and Burma, it is much more broken by inlets and islets; so there are many more harbours. The climate of China is much colder than ours. The Tropic of Cancer crosses the middle of India: it passes over only a small corner of Southern China. In India the lofty barrier of the Himalayas keeps off the cold winds coming from Tibet; there is no such long and unbroken barrier to the west of China. Thus, during the cold season, piercing winds blow from Tibet and Mongolia, the rivers in the north

are sometimes frozen and even as far south as Shanghai ice forms on pools. No river in India ever freezes, and frost is unknown in the peninsula except on the highest hills. The Himalayas, too, are a greater barrier against invasion than the mountains in the west of China. There is very little trace of Mongolian blood in India proper as a whole, though the Burmese belong to that family of the human race. Invaders have marched

FIG. 101.—Outside the walls of Pekin.

into India more than once, but they came through Afghanistan and Baluchistan, not from Tibet. In China, however, invaders from Tibet and Mongolia have often swept down from their dry steppes into the rich plains. It was to check such inroads that the Great Wall of China, 1500 miles long, was built from the sea across the north of China. China is known to be richer in minerals than India, but they are as yet made little use of; in it are some of the richest deposits of coal in the world.

China is, like India, a densely populated monsoon land where most of the people make a living by agriculture. But China is not nearly so advanced and civilised a country as India. The people are hard-working, but the government is not able to rule the country properly. Military governors have established themselves in several provinces, and are practically independent of the Government in Pekin, and as there is no national army in China, taxes cannot be collected. Wars, dacoities and disturbances in which many people are killed, are always taking place. It is like India in the days of the Pindaris. When the rain fails and famine comes, thousands and thousands of people die, just as used to happen in India two hundred years ago. The Government can make no proper arrangements to help them and there are few railways to carry food to the starving. Only in recent years has real education been given in the schools. In many parts forests have been allowed to be cut down, so that the rain runs quickly off the slopes and is carried by rivers out to sea and lost (Fig. 29). With proper government China would be one of the greatest countries of the world. The British Empire and the United States are trying to help her to take a higher place among the nations of the world.

The Chinaman is a born trader. Chinese merchants are found everywhere along the eastern coasts of Asia and a great deal of the trade of the towns is in their hands. There are thousands of Chinese merchants and shopkeepers in Burma, in Singapore, Bangkok and Saigon. A few are to be found in the large towns in India.

MANCHURIA AND KOREA.

Map Study: Position and Relief.—If we cross the Pechili Gulf and land on its northern shore, or if we go by rail from Tientsin north-eastwards along its low-lying coast, we reach Manchuria. The central part of the country is a plain sloping down to this gulf in the south and to the Amur river in the north. The rest of Manchuria is full of mountains. On the

west the great Kinghan ranges fence it off from the uplands of Mongolia. On the east the buttress of the long White Range separates it from the mountainous peninsula of Korea.

Climate.—Though Manchuria lies so far north, its heat in summer is great, while the winters are long and bitterly cold. In the centre of the country every river is frozen for months. This cold is increased by the dry, icy gales of the north-west monsoon which here, as in China, blow from the cold steppes of Mongolia. The central part of Manchuria is a monsoon land, for the summer monsoon blows in rain-clouds from the south, but, as it is fenced off by mountains from the sea in the east, the rainfall is only about the same as that of the Deccan.

Productions.—The soil is as fertile as any in the world, growing large crops of maize, millets, soya beans (a pulse like gram), wheat and ground-nuts. But at present not nearly all the land is cultivated and in the north it is chiefly pasture.

Towns.—These are all connected by railways. **Moukden,** the capital, stands on the central plain. From it four important lines branch off. One leads along the narrow coast plain of the Liao-tung Gulf to Tientsin and Pekin ; another southwards to the important seaport of **Newchwang** on the delta of the Liao River, and then along the Liao-tung peninsula to **Port Arthur.** A third strikes south-eastwards across the frontier of Korea to the port of Fusan on the strait opposite to the Japan Islands. A fourth passes north-eastwards along the plain to **Harbin,** where it meets the great trans-Siberian railway crossing the middle of the country and joining Vladivostock, a port on the Sea of Japan, with the Russian railways far off in the east of Europe. Since the Russo-Japanese war Port Arthur has belonged to Japan. As yet Manchuria is but thinly populated, but cultivators from China are flocking into it to grow soya beans and wheat. In recent years it has become the chief source of the world's supply of these beans which are exported to Japan and Europe. This Manchurian bean is one of the richest discoveries of commerce. It is eaten by man and animals and yields a good oil which is used in manufactures.

Korea is a mountainous peninsula. The mountains are covered with forests. Wheat, maize and barley are grown on the east coast valleys, and rice and beans on the warmer valleys and plains of the west coast. The shores are fringed with hundreds of small islands. The chief port is **Chemulpo** on the Yellow Sea. It is joined by rail and river to the capital, **Seoul.** **Fusan** is another port near the end of the peninsula. These places are all joined by railway with the Manchurian line. Korea is almost entirely an agricultural country. It is now a colony of Japan, and is often called by its Japanese name—Chosen.

All the monsoon lands of Asia which we have studied are like India and Burma. They receive plenty of rain as we do. They grow very much the same crops as we do in India. But while most of India and Burma lies in, or quite near, the hot belt of the world, nearly the whole of China and all the monsoon lands north of it are in the temperate zone. Rice is grown in the warmer climate of the south, and wheat and beans in the north. The chief trading ports are Penang, Singapore, Bangkok, Saigon, Hanoi, Hong-kong, Amoy, Foochow, Shanghai, Tientsin, Newchwang and Chemulpo. They export raw products in exchange for manufactured goods.

A large new port, **Dairen,** has grown up close to Port Arthur. In it are many mills making beancake and oil from soya beans.

CHAPTER XLII.

THE MONSOON LANDS OF ASIA (Continued).

The Monsoon Islands.—The islands fringing the Pacific coast of Asia seem to be arranged like the loops of a garland and stretch from the peninsula of Kamchatka southward, and right round the Malay Peninsula to the Andaman Islands. They are like one another because they are mountainous ; perhaps they are the highest points of a part of the continent that has sunk beneath the sea. Most of them contain volcanoes either old and dead or still active. In Kamchatka peninsula there is a range of volcanoes ; in Japan there are more than fifty ; in Borneo, Java and Sumatra there are others, most of them dead. Where there are volcanoes, earthquakes often take place. Every year we hear of an earthquake of some kind in one or other of these islands. In 1896 a terrible earthquake caused the death of 30,000 people in Japan. We have already learned about the great explosion that destroyed the island of Krakatoa. These islands are all in the monsoon region except the northmost island of Japan and the islands beyond it. The chief crops are therefore very like those of India. Rice is most widely grown, especially in the flat deltas and warmer valleys. In the north, well outside the torrid zone, wheat and millets take its place.

Japan : Map Study.—If China is like India is some ways, Japan is unlike it in most. India is part of a large continent. Japan consists of four main islands very close to one another, and a large number of small ones. India has wide plains watered by large rivers. In Japan there is no room for large plains, and the rivers are quite short and unimportant.

In Japan there can be very few people who do not live within sight of the sea; in India thousands have never seen the sea

FIG. 102.—The main islands of the Japanese Empire.

nor sailed on it. The islands of Japan are mountainous. Many of these are volcanoes; hardly a day passes without slight shocks of earthquake. Fuji-yama, on Hondo or Hon-

shiu Island, is the best known mountain. This great landmark rises from the edge of the sea, and is higher than any mountain in Europe. Its peak is always covered with snow, and it is to the Japanese what the Himalayas are to the people of Hindustan. This great volcano is now dead, but about 200 years ago, its internal fires burst forth and molten lava poured down its sides, blotting out the forests on its slope and the rice-fields on the plains at its base. For miles round the country was buried in dust and ashes. Tokyo, the capital of Japan, 60 miles away, was covered with ashes six inches thick.

Although the lowlands are narrow, yet the volcanic soil and the abundance of moisture make the valleys and coast strips very fertile. Owing to the steep slopes and heavy rainfall, the soil on the uplands is thin, and the highlands cannot, therefore, be cultivated up to their summits as is done in many parts of China, and the grass is too poor and thin to feed many sheep and cattle. There is not enough food grown on the islands for the dense population, and much of it has to be imported from Korea and Burma.

Climate.—The southern end of Sakhalin Island (or Karafuto) which belongs to Japan is 50° N. of the equator. The southern half of Formosa is within the tropics, and the distance between them is about 2000 miles, or about as far as from Cape Comorin to the northmost part of Kashmir. Accordingly, the climate of different parts of Japan varies very much. Yezo, the northmost island of the Japanese group, is covered with snow and ice for several months, while Formosa enjoys the warmth of a tropical island. As no part of the islands is far from the sea, Japan on the whole has an equable climate, but they are close enough to the mainland of Asia to feel the cold winds blowing seaward from it in winter. Sea-currents, however, have a great influence on the climate. The warm Kuro Siwo flows along the Pacific coasts of the main islands, and when the south-east or summer monsoon is blowing, its warm water is carried close into the shore. The lowlands of Kiushiu, Shikoku and Honshiu, especially on the Pacific side, have, therefore, warm summers. A small branch of this current passes

along the west coast of Kiushiu into the Sea of Japan. These main islands, therefore, receive more heat than we should expect from their latitude. The monsoon blowing over this warm expanse of water takes up much moisture and drives it in clouds on to the mountains of these islands. In winter, however, the monsoon blows in the opposite direction from the cold steppes of Mongolia, and during that season the Kuro Siwo can warm the Pacific coast very little. On the other hand the cold Bering Current (like the Labrador current in North America) flowing from the Okhotsk Sea, being deflected to the right, hugs the Pacific coast of Yezo, and keeps it much colder than the other islands to the south. Another cold current enters the north end of the Japan Sea and washes the coasts of the mainland, flowing past Vladivostok (where the harbour is frozen for many weeks in winter), along the coast of Korea, and passing out through the strait of Korea enters the Yellow Sea and cools its waters. The harbour of Tientsin is thus often frozen in winter. The islands of Japan, being far from the mainland, escape this cold current.

Vegetation and Crops.—Japan has no wide river valleys, plains and deltas like China, India or Burma. Only about a quarter of its surface is productive. Only in the narrow mountain valleys and coast-strips can agriculture be largely carried on, but every acre is carefully cultivated. Rice is the largest crop ; then come wheat, barley and rye. On the slopes of the hills are many tea-gardens. Higher up are valuable forests, with trees such as the oak and beech. The mulberry trees feed millions of silk-worms and the manufacture of silk is an important industry. Both raw and spun silk are largely exported.

Japan has a long broken coast-line, and there are many suitable places for harbours. The sea-currents carry plenty of fish food, and enormous quantities of fish of many kinds are caught. Rice and fish are the main food of the people. Like all islanders, the Japanese are good sailors. They have built many fine steam merchant-vessels which trade to all parts of the world.

Towns.—Japan is very densely peopled, and food has to be imported. The chief towns are either seaports or stand near the coast. They all lie in the southern and warmer parts of the islands. **Tokyo**, the capital, is a busy manufacturing town built at the end of a long bay at the south-eastern corner of Hondo, the largest island. It is a larger city than Bombay. Further down this bay is **Yokohama,** the principal exporting seaport, with a large sea-trade with America and Europe.* Further west, on the beautiful inland Sea of Japan, we come to **Osaka**, which, on account of its cotton manufactures, has been called the Manchester of Japan. It is the chief industrial town of the country. Its harbour is **Kobe,** which is now the seaport with the greatest amount of trade. Here we see merchant vessels from all parts of the world. Inland from it is Kyoto, the old capital, a beautiful town of temples and palaces. On the west of the island of Kiushiu stands **Nagasaki**, commanding the entrance to Korea Strait and trading with Shanghai, and other Chinese ports. It has a splendid sheltered harbour. Helped by a coal-field near by, it has grown in importance as a shipbuilding centre. Thus the chief towns of Japan are all in the warm south and not far from each other. They are all connected by railways. The island of Formosa, off the coast of China, also belongs to Japan. It is full of mountains and forests. The camphor tree grows on the high land, tea on the slopes of the hills, and rice in the low lands.

The Japanese.—Japan is one of the most wonderful countries in Asia. The people live very simply, are very courteous and very brave. Their food consists chiefly of fish and rice. The Japanese are born with a love for beauty. They cultivate beautiful plants and flowers. No people in the world, not even the people of India or Burma, nor even the French, can equal them in making beautiful things out of wood, bamboo, bronze, silver, ivory, porcelain, silk or lac. Japanese orna-

* Tokyo and Yokohama, as well as several villages near them, were almost destroyed by earthquakes in 1923. The earthquakes caused fires to break out which burned thousands of houses. The loss of life was terrible.

Photo, Topical Press Agency.

Fig. 103.—A Bazaar in Japan.

ments are to be seen quite as much as Indian ornaments in the houses of all civilised countries. The Japanese are like the Hindus (and unlike the Chinese and Tibetans) in one way —they are very fond of bathing, and they have this advantage that, owing to the volcanic nature of the soil and its rocks, there are many hot springs. Just as in China and India, the population is very dense, and almost every inch of land that can grow plants is cultivated like a garden. Many of their houses are built of wood and paper. If they were built of brick or stone, they would crack and tumble down in earthquakes.

In recent years a great change has come over Japan. It is no longer a purely agricultural country as it used to be. The Japanese, unlike the Chinese, have adopted western ideas and western ways of doing things. This has made the country very prosperous. They have invited engineers from Europe and America to teach them how to manufacture goods on a large scale, to build factories, railways, harbours and ships.

Japanese towns spin silk and weave silk cloth, which is chiefly shipped across the Pacific to the United States. Although very little cotton can be grown on the islands, Japan imports much raw cotton (half of it from India), weaves it and sends the cloth to India and China. Any day we can see Japanese ships in Indian harbours. They bring us cotton and silk cloth, glass, toys and matches (there is plenty of sulphur in the volcanoes of the islands). A good deal of the camphor used in India comes from Formosa Island. These ships take back raw cotton and cotton yarn from Bombay, jute bags from Calcutta and rice from Rangoon. The map shows that the seaports of Japan are well placed for trade with China, India, the Straits Settlements, the United States and Europe. During the Great War Japan's trade with India, Burma and China greatly increased.

The Eastern or Malay Archipelago.—This large group includes all the islands in the south-east of Asia except New Guinea which belongs to the Australian continent. They lie on both sides of the equator, and therefore their climate and


English Miles
0 100 200 300 400 500 600
Land above 3000 feet
Sea level to 3000 feet
Railways
Philippine Islands
Manila
SOUTH CHINA SEA
CHINA
TONGKING
Hanoi
Red R.
Hué
FRENCH INDO CHINA
ANNAM
Mekong
CAMBODIA
COCHIN CHINA
Saigon
SIAM
Bangkok
Menam
Gulf of Siam
BURMA
Mandalay
R. Irawadi
Rangoon
BAY OF BENGAL
Malay Penin.
FEDERATED MALAY STATES
Penang
Malacca
Singapore
Malacca Strait
Sumatra
Banka
Billiton
Batavia
Java
Sunda Str.
INDIAN OCEAN
Borneo
SARAWAK
BRUNEI
Labuan
BRIT. N. BORNEO
Celebes
Macassar
Moluccas
New Guinea
Timor
120°
10°

productions are like those of Ceylon. Lying in the equatorial rain belt and possessing a rich volcanic soil, they are very fertile, growing all kinds of tropical plants. The most important are **Sumatra, Java, Celebes,** the **Moluccas** and **Borneo**. The first four of these and most of Borneo belong to Holland, and the good government of the Dutch has improved the methods of cultivation and allowed the population to increase rapidly. The most important island is Java, which grows large crops of coffee and cinchona on the hills, and rice, sugar, rubber, tobacco, cacao, coco-nuts and other tropical plants on the low lands. Most of the export and import trade passes through the ports of **Batavia** and **Surabaya** on the north coast. They ship sugar, tobacco and some quinine to India. Sumatra, a much larger island, is not nearly so productive nor so thickly peopled. The Moluccas, or Spice Islands, as their name tells us, are noted for spices such as nutmegs and cloves. Two small islands, Billiton and Banka, are supposed to be an extension of the tin-bearing area of the Malay Peninsula, for they yield great quantities of that metal. The north part of Borneo is under British protection. It exports tobacco, rubber, coco-nuts and copra, pepper, gutta-percha and rattan-canes.

The Philippine Islands. a very numerous group, are also mountainous, volcanic and thickly wooded. They produce, like the others, the crops and fruits of hot monsoon lands. Tobacco and a kind of hemp, made from the fibre of the long leaves of a kind of wild plantain, are two special products. The islands are under the protection of the United States. The chief town and seaport is **Manila.**

The whole of northern **Borneo** is now under British protection. **Sarawak,** the chief port, exports tobacco, rubber, coco-nuts and pepper.

CHAPTER XLIII.

THE CENTRAL HIGH LAND OF ASIA.

(See map at p. 246).

Map Study.—Leaving the low, moist monsoon lands, we now cross the Himalayas. At once we are in a part of Asia quite unlike India or Burma or the monsoon countries. The centre of Asia, lying between the Himalayas and the north-eastern corner of the continent, is an immense high land. We have already learned something about it. It is filled up with wide table-lands and high ranges of mountains. Trace on a good map the Himalayas, Karakorams and Hindu Kush ranges: the Tien-Shan, Kuen-Lun, Altai and Yablanoi Mountains; the table-land of Tibet and the Pamirs.

Climate.—From the great height of this high land and its distance from the equator we know its climate must be much colder than that of India. The whole of this region is far from the sea. It has, therefore, a short warm season and a long, bitter cold season. Above all its climate is dry. The monsoon winds do not reach it. They are stopped by the mountains on its flanks. On our side of the Himalayas heavy rain falls; on the other side, in Tibet, there is almost none. We have many rivers; they have very few. The Tarim is the largest. It flows across a desert into a swamp called Lob-Nor.

North of the Kuen-Lun range lies the great desert of Gobi, a vast stretch of barren sand, where no rain ever falls and where nothing can grow. The rest of the region is not so dry as this, but crops can only grow in the warm season where water can be led to the fields from the mountain streams

Photo. Exclusive News Agency.

FIG. 105.—Lost on the Great Desert of Central Asia: consulting the map.

when the snow melts. We can thus describe the climate of this whole region as hot and dry in the short hot season, and very cold and dry in the cold season. What a contrast to our monsoon lands! Here and there a little grain and a few fruit trees are grown. The people depend for food and almost everything else on their animals, which find pasture by wander-

FIG. 106.—Yaks.

ing about in the valleys and on the mountain slopes. The yak, camel and horse are the most useful. The yak is a strong, shaggy bullock. Its milk is used as food in summer and its flesh in winter. The skin makes clothes, bags, bottles and saddles. Even the droppings are used as fuel, as the country is too dry and cold for trees to grow. The yak is very sure-footed, and is the chief beast of burden in the mountains. The camel is the only animal that can cross the deserts.

Towns.—In such a barren country there are very few people and therefore very few towns. **Lhasa**, on the table-land, 12,000 feet above sea-level, lies just north of the Brahmaputra. It is the capital of Tibet, ruled by the Grand Lama or head Buddhist priest, a city of Buddhist monasteries and bazaars full of traders from Kashmir, Nepal and China. To the north of Tibet lies Chinese or Eastern Turkestan, nearly surrounded by mountains and therefore very dry. Large parts of it are desert. In the hot season the sand of the desert rises nearly to boiling point, but in the cold season every drop of water is frozen. **Kashgar** and **Yarkhand** lie on branches of the Tarim River, which flows eastwards to the desert. The fields round these towns can thus be irrigated and crops grown. Apricots and peaches are the commonest kind of food. Both towns are important on account of their position. Caravan routes lead from them to passes over the mountains. One of these crosses the Karakoram Mountains into India. They are thus the meeting-places of merchants and traders from many parts of Asia. East of Chinese Turkestan stretches the table-land of Mongolia, also surrounded by mountains. A great part of it is taken up by the Gobi desert. The chief town is **Urga,** a town of Buddhist monasteries. The traveller can reach it by camel across the desert from Pekin. On his way he would cross the Great Wall of China built to protect the fertile plains of that country from the fierce tribes of the high land.

We can readily understand what the high land region is like by remembering it is, in almost every way, the opposite of India—dry, intensely cold in winter, ill-watered, unfertile, thinly peopled, with few towns, and, of course, no seaports. The people are shepherds and traders, rather than tillers of the ground. Their wealth consists in their animals.

CHAPTER XLIV.

THE COUNTRIES OF THE WESTERN TABLE-LANDS OF ASIA—PERSIA, AFGHANISTAN AND BALUCHISTAN, ASIA MINOR AND ARABIA.

Map Study: Relief and Climate.—On the map of Asia trace a line joining these three points: the Pamir plateau, the westmost point of Asia Minor and the southmost point of Arabia. You have traced out a triangle. This triangle roughly contains the high lands of Western Asia and, as we have learned before, these high lands consist of three table-lands: (1) the table-land of Iran, containing Persia, Afghanistan, Baluchistan, (2) the table-land of Asia Minor and (3) the table-land of Arabia. Between the first and last mentioned lies the low land of Mesopotamia, watered by its two rivers. These table-lands have mountains along their edges and these edges are washed by six seas—the Caspian Sea, the Black Sea, the Eastern Mediterranean, the Red Sea, the Arabian Sea and the Persian Gulf.

The map tells us two things about this region. First, in the table-lands of Iran and Arabia there is hardly a single river; there are plenty of deserts and there are very few towns. Surely this is a proof that these table-lands receive very little rain. Secondly, we see that several small rivers flow from the table-land of Asia Minor into the Mediterranean, the Black Sea and the Caspian, and that the two large rivers of Mesopotamia rise in this table-land. From this we can say that the table-land of Asia Minor receives more rain than the other two. This rain is carried in clouds from the Mediterranean and Black Seas. We can therefore guess that this

table-land will, on the whole, be more fertile than the others. Here we see more towns marked. There are more people in this table-land than in the other two together. Though these table-lands are together larger than the whole Indian Empire, they contain only a fraction of the number of its inhabitants. No part of them is nearly so thickly populated as Bengal or the United Provinces.

Cultivation.—As so little rain falls, the people depend for cultivation on their few rivers and on snow-fed mountain streams which can be led into irrigation channels. The agriculture of these table-lands is carried on chiefly in oases. All the inland towns and villages are built round these oases. The rest of the table-lands is either desert or covered with scanty grass which springs up after showers, but is burnt up for most of the year by the heat. These pastures cannot support settled life, and so we find most of the people are shepherds living in tents and wandering about with their animals in search of pasture. Where people live in oases or as shepherds, there is but little chance of an increasing population. There is only a small rainfall. Only a limited number of wells can be dug; only a limited number of date palms and crops can be grown; there is pasture for only a limited number of cattle; and therefore, only a limited number of people can find a living. Only necessaries are grown—gourds, melons, a little grain, fruit and vegetables. But dates are the chief food.

Trade Routes.—In such regions trade routes cross the deserts, and we therefore expect to find the towns on important points on these routes. The villages and towns are usually built on oases, with narrow and, therefore, shady streets and bazaars filled with petty traders and craftsmen. The chief buildings are the mosques and rest-houses for pilgrims and merchants. Two changes, however, have made a difference to these table-lands. Their trade routes are not so important as they were for (1) the Suez Canal has now shortened the journey between east and west; (2) the Russians have built the trans-Caspian railway in the north, taking away much of

the trade on that side. We now study in turn the countries of these table-lands.

Persia: Position and Relief.—Persia consists of the western part of the table-land of Iran and its high edges look down over the Caspian Sea, and the low-lying deserts of Turan on the north, over the Euphrates and Tigris valley in the west, and over the Persian and Oman Gulfs in the south. Inside these high mountain edges the table-land is made up of table-lands and broken masses of bare mountains. Persia is thus a country very difficult to reach from the seas which border it.

Climate.—The climate is dry and extreme. In the high north-western corner and on the Elburz Mountains, drenched by showers from the Caspian, there is a good rainfall, and the air is moist for a few miles inland from the Persian Gulf. But the rest of Persia receives very little rain—even less than the dry parts of the Deccan. Almost all the year round the air is clear and the sky cloudless. In winter snow falls on the mountains and sometimes covers the plains. In the summer the heat is very great and the soil is hard and parched. This dryness explains why there is so little vegetation. On the wet Caspian side of the Elburz range there are fine forests, but the rest of Persia is bare. The only cultivation is in the narrow sheltered valleys of the mountains, or in the oases where water can be drawn for irrigation from the few rivers or mountain streams. A large part of eastern Persia lying between the Caspian and the Gulf of Oman is pure desert. In such a country it is vain to expect large rivers.

The chief business is pasturing, and from the wool of goats and camel's hair the famous Persian carpets are made. With so little rain and so few rivers, large crops cannot be grown. The Persian cultivators are very skilful and lead the water for miles in underground ditches (to prevent evaporation) on to their fields and gardens, but, if the snows and rains of winter fail, drought and famine come over the land. Still, on spots where irrigation is possible, the soil is fertile and the crops plentiful. Wheat and barley are grown on the cooler high

FIG. 107.—The table-lands of Iran, Asia Minor and Arabia.
(See also the large map of Eurasia at p. 246.)

valleys, rice only on the lower grounds where water can be got along the banks of rivers. Just as in India, millets and pulses are the commonest crops. The dry air and warm sunshine favour the ripening of many kinds of fruits, and Persia is famous for its peaches, raisins, figs and almonds. They are exported as dried fruits. Dates, grown on the hot and dry coasts of the Persian Gulf, are largely exported to America, Europe and Australia as well as to India.

Towns and Trade.—As in the other countries of these table-lands, the climate is too dry to yield enough food for a large population. Though Persia is more than half the size of India, its total population is less than that of Bombay Presidency. The towns are oasis-towns on trade routes, important as resting-places and markets. The caravans consist of camels and horses, for there are no railways nor roads fit for carts.

Towns.—To reach Persia from India we should go by steamer from Karachi or Bombay up the Gulf of Oman to **Bandar Abbas** or **Bushire**. From these ports dates, ponies and pearls are exported to India. From Bushire we should have to join a caravan over the mountains to **Shiraz**, and northwards on to **Ispahan**, the old capital, and then on to **Teheran**, the present capital, lying in an irrigated plain within sight of the snowy peaks of the Elburz Mountains to the north. The city is a mass of flat-roofed houses, caravanseries, bazaars, mosques and narrow streets where live the dependents of the Shah and his nobles. Resuming our journey northwards we should reach **Tabriz** near the northern frontier. Tabriz is the natural trade gateway of Persia, being the meeting-place of routes westwards to the Mediterranean ports by caravan, by railway to a Russian port on the Black Sea, and eastwards to a Persian seaport on the Caspian.

Afghanistan and Baluchistan: Map Studies.—These countries form the eastern part of the great table-land of Iran and lie between Persia and India. They are like Persia and grow the same crops, but they are much more mountainous. Afghanistan is nearly filled with mountains and most of it is over 2000 feet above sea-level. On the whole, these countries

are not fertile. Wherever we go, we see sand, bare rocks, barren hills, and high snow-capped mountains. The monsoon which blows rain over India and Burma does not touch Afghanistan or Baluchistan. There are few green places except in the valleys, and cultivation, as in Persia, depends on streams which flow down from the melting snows of the

FIG. 108.—Life in Afghanistan.

mountains. In the hot season the ground is parched; in the cold season the cold is intense. Sometimes, in winter, a high wind blows and people are frozen to death. Just as in Persia, the parts that cannot be irrigated give only pasture for camels, horses, goats and sheep. The map shows how little rain falls in these countries. Scarcely a drop of it ever reaches the sea. The streams that flow to the north perish in the sands of the Turan desert. The Helmand, flowing west, loses itself in a salt swamp on the borders of Persia; even the small streams that feed the Indus are quite dry for most of the year. Only

the Kabul, fed by glaciers of the Hindu Kush, carries a full tide of water. In the valley of this river stands **Kabul**, the Amir's capital, an oasis-town surrounded by gardens, orchards, and irrigated fields. Its situation is higher than the Western Ghats.

Kandahar, near the southern border, stands on an irrigated plain 3000 feet above sea-level, which produces corn, fruit and tobacco. **Herat** in the west is on a lower level. From this town passing down a river valley it is easy to reach the low plains in the north. This is one of the easiest and most important passes leading from the high land of Asia to the northern low land. These three towns are important centres of trade routes. From both Kabul and Kandahar important routes pass out of the table-land over the Sulaiman Mountains and down into the Indus valley. The Khyber Pass is on the route to Peshawar. Quetta guards the entrance of the Bolan Pass on the route from Kandahar to the Indus valley. Through these passes we send cottons, tea and sugar ; they send us in exchange wool and dried fruits.

Asia Minor and Syria : Map Study.—The table-land of Asia Minor is like the table-land of Iran, but from its rivers we can see it receives more rain on its sea-coasts. The interior is almost a desert. The valleys that run down to the Mediterranean coast are the most fertile, and there wheat, olives, grapes, figs, and oranges are grown. **Smyrna**, on the west coast, is the chief seaport, and exports dried figs and other fruits as well as carpets, wool and some cotton. Trace on the map the railway lines coming from Constantinople and Smyrna which join and then run eastwards to Aleppo. This is an important railway, for it joins the western part of Asia with the lines of Europe.

Map Study.—Syria and Palestine (the Christian Holy Land) lie to the south. They are both poorly cultivated and thinly peopled. Syria is really a desert with a few oases where villages and tents are seen among the palm-trees. Parallel to the coast, the Jordan flows southwards through a lake into the salt Dead Sea. **Damascus**, in Syria, is an oasis-town, watered

FIG. 109.—Towns and Railways of Asia Minor, Syria and Iraq.

by streams and canals coming from the mountains near it. A railway crosses these mountains and joins it with a seaport (Beirut) on the Mediterranean. Like so many oasis-towns, Damascus is a meeting-place of trade routes. It is the starting point for camel caravans going eastwards across the desert to the Euphrates and the Persian Gulf. A railway now joins it with **Aleppo** in the north. From Aleppo one line runs north-westwards to Constantinople, and another has been partly built eastwards to reach Baghdad on the Tigris. A third railway running southwards east of the Jordan goes across the Arabian desert to Medina. By this line we can also reach **Jerusalem,** the capital of Palestine and the Holy City of Jews and Christians. This town is also joined by a short line with **Jaffa**, a seaport on the coast. During the war a railway was built joining Palestine with Egypt across the desert. **Cyprus**, a mountainous island off the coast, is a British possession. Like Syria it produces tobacco and oranges.

Arabia: Map Study.—Arabia is a huge peninsula very nearly as large as India, with a high range of mountain ghats overlooking the Red Sea. The highest part of the peninsula is the south-west, and it slopes to the north-east till it sinks to the level of the Euphrates valley and the shores of the Persian Gulf. The Red Sea edge of this table-land is very steep—steeper and higher than the Western Ghats—with only a narrow and almost harbourless coast-strip. The interior is made up of dry plateaux much higher than the Deccan.

The Climate is like that of the rest of the western table-lands—very hot and dry. The southern and Persian Gulf shores are among the hottest places in the world. A map of the world shows that Arabia lies midway between the Asian and African deserts. No rain comes to it from the narrow Red Sea. It is out of the track of the south-west or summer monsoon. There is not a single river and very few temporary water-courses.

The Vegetation, as we should expect in such a dry land, is very scanty. The surface as a whole is bare, and about one-

third of Arabia is pure desert. The Syrian desert is in the north. Only in certain seasons is there here enough moisture to grow pasture for the wandering tribes. South of this is the Great Arabian Desert, most of it dry and stony scrub, with but few wells or watering places. The wind heaps the sand into long waves or dunes, some of them a day's journey in length.

Arabia is naturally a land of wandering shepherds. There is nothing to tempt man to live in towns, and villages are few. The Bedouins wander about with flocks and herds. They despise the traders, craftsmen and cultivators of the oases. Their wealth consists in camels, horses, donkeys and sheep.

Towns and Trade.—In all this vast area, nearly as large as India, the population is scarcely greater than that of Calcutta and Bombay. The towns are small and are either trading centres on the coast or places of Mohammedan pilgrimage. Arabia is so purely desert that there are no real trade-routes. The only routes are pilgrim roads to Medina and Mecca from Egypt, Syria and Persia. Pilgrims from the north now come by the railway which, starting from Damascus, has reached Medina and will be carried on to Mecca. Many find their way by sea to **Jiddah**, the Red Sea port of **Mecca**. Every pious Mohammedan desires to visit the birthplace of the Prophet at **Mecca**, or his tomb at **Medina**, once, at least, before he dies. Thousands sail on this yearly pilgrimage from Bombay. Hodeida and Mocha are two seaports at the south end of the Red Sea. They export a little coffee grown on the hills inland.

Muskat, the chief town of Oman, is a small port trading with India. **Koweit**, a port in the Persian Gulf, exports Arab ponies to Bombay, and pearls from the warm shallow waters of the Gulf coasts, as well as dates.

Aden, a fine sheltered harbour near the south-west corner of the peninsula, is an outpost of the Empire. It is surrounded by a hot desert and barren rocky volcanic hills, and has therefore to import its food and condense some of its drinking water from the sea. But its position makes Aden important.

Standing at the gateway of the Red Sea and far from any other port on the great sea-route from Europe to the east, Aden is one of the most important coaling stations in the world, and an exchanging place for the trade of the neighbouring coasts. To protect this coal station in time of war large forts have been built and a garrison recruited from India is quartered in the barracks.

CHAPTER XLV.

MESOPOTAMIA (IRAQ) AND CAUCASIA.

Mesopotamia.—Between the table-land of Arabia and that of Iran lies the valley of Mesopotamia,* watered by the Euphrates and Tigris. These rivers join to form the Shatt-el-Arab, which flows into the head of the Persian Gulf. This great valley was once very fertile, but, owing to neglect by the Turkish governors, the wells are filled up and the irrigation works are almost all ruined, and now most of it is a plain of baked mud with a few poor villages. In Mesopotamia everything depends on the rivers. Very little rain falls and the summer heat is greater than that of India. Where the river water cannot reach, the country is a desert, and no plant, animal or human being can live. The chief town, far up the Tigris, is **Baghdad,** a large Mohammedan and Arab city. It is becoming once more the centre of a busy trade by rail and river and by caravans across the desert. Motor cars run to it from the Mediterranean coast and aeroplanes fly between it and Cairo. **Basra**, a river harbour on the Shatt-el-Arab, at the head of the Persian Gulf, is the chief seaport and sea-gateway of the valley. River steamers go up as far as Baghdad. A railway has been built up this valley, from Basra to Baghdad and farther north. Some day it will be joined to the line which passes through Aleppo on to Constantinople. If Mesopotamia remains under British protection, it is sure to become a very prosperous country, as it used to be long ago. Irrigation works are being built, new canals dug and old ones cleared out, and very soon

* Mesopotamia is a Greek word meaning doab.

immense crops of wheat, millet and all kinds of vegetables will be grown and exported. The trade will also increase both by railway and especially by sea, through Basra, where the bar at the mouth of the Shatt-el-Arab has been dredged, and large docks have been built. Even before the war, ship-loads of dates were exported from this port to India, England, Australia and America. Its trade with Bombay has greatly increased since the war. Not far from Basra are very large oil-wells.

Caucasia.—The great Caucasus Mountains which join the shores of the Black Sea and the Caspian are the northern boundary of the Iranian table-land. This table-land, we have learned, is in many parts a desert. Yet just south of this range there is a fertile valley along which a river flows to the Caspian Sea. Here rice, maize, and wheat grow well. It is also the home of the orange, mulberry and vine. This region receives much more rain than the table-lands, and the valley is fed by streams from the melted snow of the Caucasus range. At the Caspian end of the valley there are great oil-wells near **Baku**. From this port the oil is taken in steamers to all parts of this sea. Baku is joined by railway, along the valley, with **Batum** on the Black Sea. This railway carries the oil from one port to the other, and Batum is one of the chief oil ports in the world. Much of the oil used in India used to come from Batum, but now India depends very largely on oil from Rangoon. Half-way along this oil railway stands **Tiflis**, the chief town, from which a line now branches off to Tabriz in Persia. Before the Great War Caucasia belonged to Russia. It is now divided into two independent states.

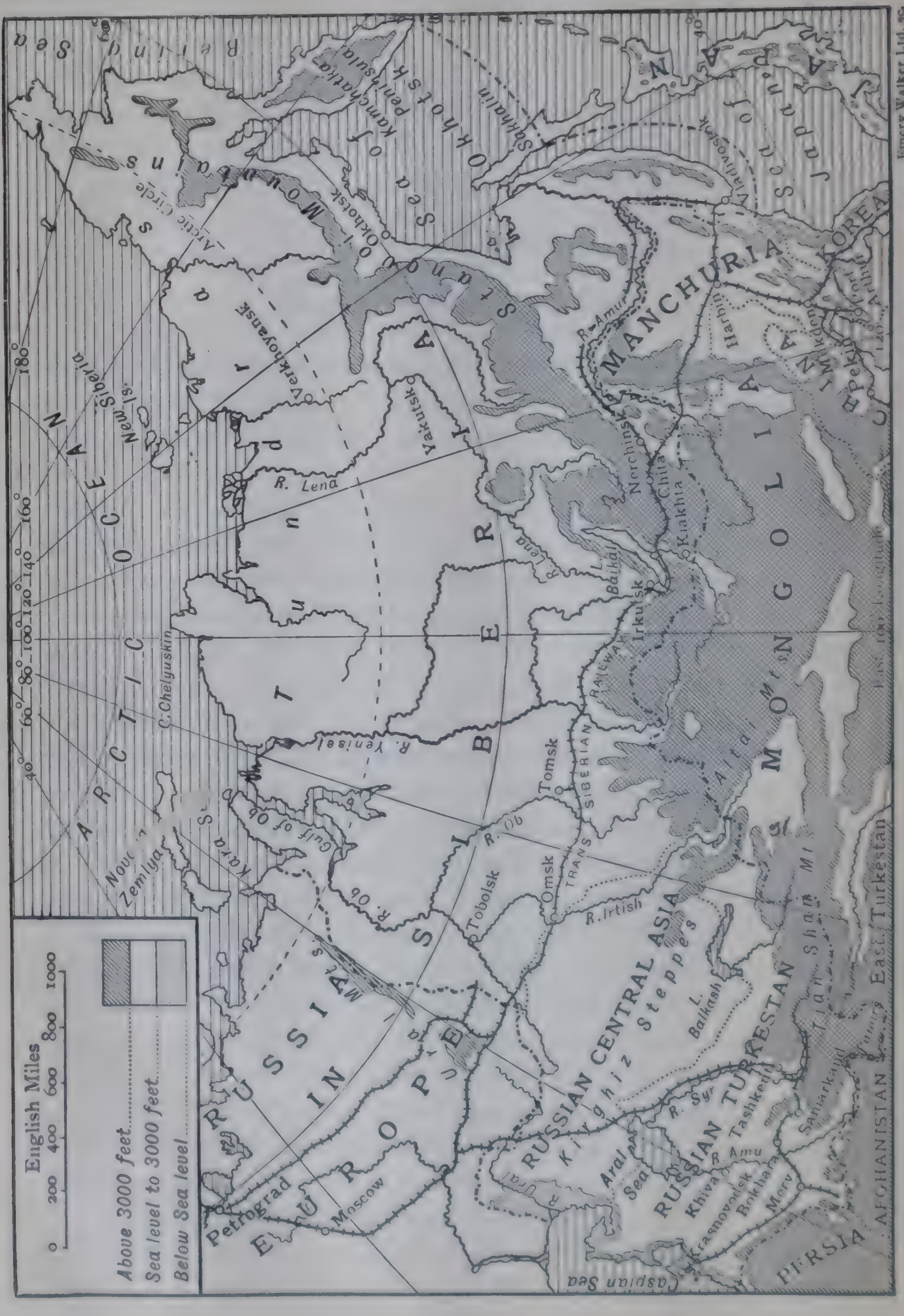
CHAPTER XLVI.

THE NORTHERN PLAINS.

Map Study.—We now go on to study the part of the great low land of Eurasia which belongs to Asia. It is drained into the Arctic Ocean in the north and into the Caspian and Aral Seas in the west.

The Caspian and Aral Basin.—Look first at that part of the plain which drains into the Caspian and Aral Seas. Besides these two seas or lakes we notice another farther east, Lake Balkash. These three lakes have no outlet to the ocean. The huge Volga flows southward into the Caspian from Europe; the Amu (or Oxus) and Syr into the Sea of Aral; the Ili into Lake Balkash. This area is Russian Turkestan. After the Great War it became independent of Russia and is divided into provinces, each ruled by a governor or khan. Turkestan was the home-land of the Mogul Emperors of India. Babar was the chief of a Turkish tribe.

Now what kind of country is this? The map will help us to find out. In the first place we see it is flat and low-lying; the Caspian Sea is below the level of the Black Sea. Secondly, it is far from the ocean, and we can be sure it will be very hot in the hot season and very cold in the cold season. In winter all the rivers are frozen over. For some months in summer the heat is as great as it is in the Thar desert. Thirdly, the region is very dry. A good map shows that many rivers dry up. The rain-clouds coming from the ocean are all emptied before they can reach it, so that this region is one of the driest in Asia. Only a little snow or rain falls in the cold season when no plants nor crops can grow. In the summer


English Miles
0 200 400 600 800 1000
Above 3000 feet
Sea level to 3000 feet
Below Sea level
ARCTIC OCEAN
Bering Sea
Arctic Circle
New Siberia Is.
C. Chelyuskin
Nova Zemlya
Kara Sea
Gulf of Ob
R. Ob
R. Yenisei
R. Lena
R. Irtish
R. Amur
Sea of Okhotsk
Kamchatka Peninsula
Okhotsk
Sakhalin
Verkhoyansk
Yakutsk
Nerchinsk
Chita
Kiakhta
Irkutsk
L. Baikal
Tomsk
Omsk
Tobolsk
TRANS SIBERIAN RAILWAY
SIBERIA
RUSSIA IN EUROPE
Petrograd
Moscow
RUSSIAN CENTRAL ASIA
Kirghiz Steppes
L. Balkash
Aral Sea
R. Syr
R. Amu
RUSSIAN TURKESTAN
Tashkend
Samarkand
Khiva
Bokhara
Merv
Krasnovodsk
Caspian Sea
PERSIA
AFGHANISTAN
East Turkestan
Tian Shan Mts
Altai Mts
MONGOLIA
MANCHURIA
Harbin
Mukden
Vladivostok
KOREA
Sea of Japan
Peking
CHINA
Emery Walker Ltd. sc

no rain falls; the ground is baked hard and the streams dry up. Therefore, it is only where irrigation can be got from the rivers that crops can be grown. Only two per cent. of the surface is cultivated. The rest is either desert or poor pasture land. It would be all desert, were it not for the water which comes from the melting snows of the mountains.

The Amu and Syr are the only two large rivers. The Amu flows into the plain from the high Pamir table-land; the Syr comes from the snows of the Tian-Shan ranges. Much of the water of these rivers is lost in the desert sand and much is used for irrigation; like all rivers in this region they become smaller and smaller the farther they go from the mountains. The cultivated parts on their banks are oases. On these fertile patches wheat, rice, barley, pease, cotton and tobacco are grown, as well as many kinds of fruits such as apples, pears, plums, apricots, peaches, grapes and melons. These form the chief part of the people's food.

The map shows the chief towns are on these oases near the rivers. The unlucky thing about the whole of this great basin, is that it is getting gradually drier and drier. Less snow is falling on the mountains; the rivers are becoming smaller; the lakes are shrinking; the summers are hotter and the winters colder han they used to be. Many mountain streams that formerly fed the rivers now lose themselves in the sand. In consequence, the sands of the great desert are increasing and swallowing up the cultivated parts and the pasture lands. In many places towns and villages, which were once flourishing, have been buried by the sand. The oases are like stepping-stones across the desert.

One may ride for days and days over this region and see no signs of life except an occasional train of camels, carrying goods from one oasis to another. The towns on these fertile patches all have large bazaars. Persian rugs, brass vessels, jewellery made from gold and precious stones found in the mountains, cloth from Russia, horses from Persia and Arabia, and fruit grown on the spot, are some of the wares sold.

The Central Asian Railway.—To join the towns of this country the Russians have built a railway. It starts from a town on the Asiatic side of the Caspian. This town is built in a very dry region where not a blade of grass can grow. All the water needed by the railway engines is distilled from the salt water of the Caspian. The line passes away south-eastwards over the desert stretching between the Caspian and the edge of the high land of Asia. But here and there we find oases, watered by the snow-fed mountain streams or by either of the two rivers of this region—the Amur and the Syr. The object of this railway is to join the towns on these oases with the railway lines of Russia.

Merv lies on a river which struggles through the desert from the mountains of Afghanistan, but, being here used up by irrigation, gets no farther. After leaving Merv we see hedges planted on either side of the line to protect it from being covered with sand in dust-storms. Crossing the Amu we enter **Bokhara**, another oasis-town, fed by a river from the Tian-Shan range. The river can go no further, for its water is all used up in irrigation. Its many mosques tell us Bokhara is a Mohammedan city. The line runs on to **Samarkand,** another busy town of mosques and bazaars, and then sends off a branch line to oases-towns in a valley among the mountains. Here much cotton is grown. Crossing the Syr we reach **Tashkent**, and the main line follows the valley of this river past the Aral Sea, across the Ural and Volga rivers to distant Moscow, in the centre of Russia. By its help the raw cotton, silk and dried fruits of the province are exchanged for the manufactured goods of Europe.

The Steppes.—But, luckily, all the great northern plain of Asia is not dry and barren. As we travel northwards from the Aral and Caspian basin the country becomes more fertile, and we reach the region of steppes. They stretch in a strip right across Asia, just north of the slopes of the high land, from near the Caspian Sea to beyond the Lena. In the west they are low-lying, but in the east they form table-lands. What are steppes? They are vast stretches of undulating or gently

sloping treeless country, covered with grass, with large tracts of half desert and salt marshes here and there. In the long

Fig. [illegible].—A Mosque in Samarkand.

winter the steppes are covered with snow. Blinding snowstorms make it impossible to go from place to place. Men and

animals often lose their way and are frozen to death. In the spring this snow melts and the steppes become a sea of mud. This is very good for seeds, and soon the ground is covered with grass and flowers. In a few weeks these are as tall as a man.

But these short spring months are the only time in the year when anything can grow, for the heat increases, the soil is baked hard, and the grass and flowers begin to wither. This is the reason why no trees grow on the steppes. The heat and drought kill the saplings before they have time to grow up and bear flowers and seeds. Only plants like grass, which bear seeds quickly, can grow in the steppes. After the heat of summer come the frosts of autumn and the snow and ice of winter. In India we often get as much rain in a day as the steppes receive in a year. This want of water explains why over most parts of Asia (except in the monsoon lands) men live the same kind of life. They depend on pasture and on animals which live on pasture, for, except in the oases, they cannot grow crops as we do. The people of the steppes are therefore shepherds, wandering about with their flocks and herds in search of pasture. They have no real houses —only tents, which they can carry about with them, and put up and take down quickly when wanted. These wandering tribes live by feeding immense flocks and herds on the grass of the steppes. Horses, sheep, goats, camels and yaks are their wealth The chief tribe is the Kirghiz.

As soon as the snow has melted and the steppes have become green, the flocks and herds are sent out to graze. During the hot season they wander about from one pasture to another. In the early spring, they go to the low steppes, where the snow melts first and the earliest grass grows, then they visit the higher pastures, where the snow melts later and the grass is still young and tender. In the autumn, when the cold begins, they return to the warmer plains. In the winter, when the pasture is withered and the ground covered with snow, the tribes take shelter in the valleys, where they pitch their tents. There the animals live on the hay collected during the summer. The herdsmen and their families live on the flesh of their

Photo. Topical Press Agency

FIG. 112.—Khirgiz Women Weaving. Inhabiting the Steppes they move from place to place taking with them their movable huts.

flocks and on a little milk and curd. The droppings of their animals are the only fuel, for, as we saw, there are no trees to yield firewood. They pass the time in making rugs, clothes, felt, saddles and other things from the wool and skins of their animals. Thus the steppes can never be thickly peopled. Every family requires a great amount of land to feed its flocks and herds. This is quite the opposite of India, where many families can live on the crops of a few fields. Do you see many towns and villages marked on a large scale map of the steppes ?

Photo. E.N.A.

FIG. 119.—A river flowing through the forests of Northern Asia.

The Forest-Belt of the Northern Plains.—North of the steppes we reach a different land. Running across the middle of the northern plain, from west to east, there is a broad belt of country which receives more rain than the steppes and which is thickly covered with forest. The trees are of many kinds which can stand the intense cold of the winter season. Parts of these vast forests have never been trodden by human feet. In summer the rivers are the only means of entering them. In winter, when the rivers and marshes are frozen, hunters can make their way through on foot. These forests are the home of many kinds of fur-bearing animals. Winter is the chief time for hunting them because in this season their fur

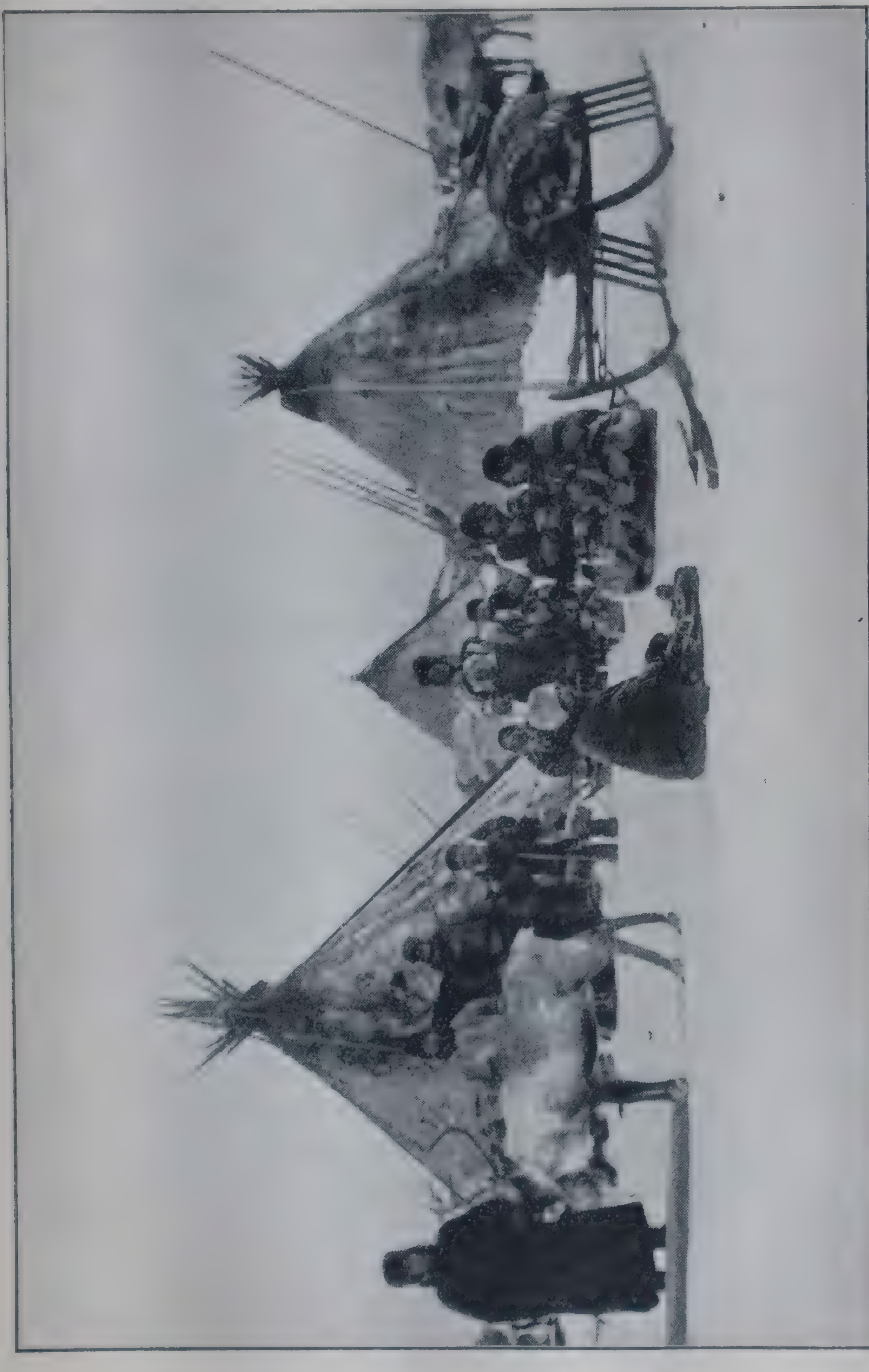


FIG. 114.—A Camp on the Cold Tundra. (Far on the other side of our continent.)

grows very thick to keep out the cold, and they are then most valuable. The villages in the forest region are few and small, and are always built beside the rivers. The people live in wooden huts made of the timber of the forests. Their chief food is meat, fish, roots, berries, and the bark of the pine ground into saw-dust and boiled in milk. They get high prices for the skins of the animals they hunt. The long, intensely cold winter prevents grain crops from being grown.

The Tundra.—Still farther north, all along the Arctic edge of the northern plain of Eurasia, we come to the tundra lands. It is here too cold for even the hardiest trees to grow. No plant with a deep root can live, for even in summer the ground still remains frozen hard a few inches below the surface. In the long winter the ground is covered deep with snow, the rivers and marshes are frozen solid, and bitterly cold blasts blow from the icy north. During this season human beings can live on the tundra only with the greatest difficulty, and the wandering tribes move south. In the short summer season the sun does not set, and the ground is covered with moss and coarse grass. Then the tundra tribes drive their herds of reindeer north to fatten on the moss. The reindeer is the chief wealth of these tribes, just as camels are in the desert, and yaks on the cold dry high lands. The reindeer, which have broad spreading feet like the camel, are able to drag loads over the frozen snow. They supply milk in summer and meat in winter. The skin is made into clothes, rugs and tents. In almost every respect the tundra is the opposite of India. There are no crops, no trees, no roads, no towns, nor villages, nor houses, nor temples. In winter there is no sign of human life anywhere ; the rivers are frozen and the ground is buried in deep snow ; floating ice blocks the coast ; for weeks the sun scarcely rises above the horizon, and the land lies dead under the gloom of the winter night.

CHAPTER XLVII.

THE TRANS-SIBERIAN RAILWAY.

(See Fig. 64.)

FROM the Baltic Sea in the west to the Pacific Ocean there is really no barrier of high land. Even the Ural Mountains, which divide Europe from Asia, are low and easily crossed by railways. The Russians have taken advantage of this vast flat land to the east of them, and have advanced right across Asia to the Pacific. One-third of the great continent of Asia belonged to them before the war.

We have seen that the great low land of Eurasia has three belts or zones—the steppes in the south, the forests further north, and the tundra bordering the Arctic Ocean. The steppes are not at present much cultivated, but they contain much rich black-soil on which large crops of wheat and barley can be grown. The summer is short, but then the sun shines for nearly twenty hours in the day; so, splendid crops can be ripened in two months. The steppes are also excellent pasture-grounds, and enormous herds of cattle are reared. The fishing in the rivers is very valuable. So is the hunting in the forests. Timber is abundant in the forest-belt. But the greatest wealth of Siberia is in the mountain regions on the south of the great plain. Here are rich mines of gold, silver, lead, copper, iron and coal. In the Urals, too, there are coal and iron mines. Now the Russians wished to send colonists into Siberia and to develop this wealth. How could they do it? The Ob, the Yenisei, the Lena, the Amur, and all their large tributaries are only of use as water-roads during a small part of the year. Besides, all but the Amur fall into an ocean full of ice and very difficult for ships to navigate. Thus,

what Siberia needed was a railway. The Russians built this railway just as we saw they built a railway in their province of Turkestan. It stretches right across the north of Asia for more than 4000 miles, and joins the east with the west.

It starts from Moscow in the centre of Russia and ends at Vladivostok on the Pacific, running very nearly due east and west. The journey takes about three weeks. The line bridges the Volga at **Samara**, the centre of one of the most

FIG. 115.—Reindeer drawing a sledge in Northern Asia. This has no wheels but glides over the smooth snow.

fertile agricultural districts of Russia, climbs the Urals by a low gap, and then descends to the dreary steppes of south-west Siberia, dotted all over with salt marshes. This steppe region is thinly populated and for miles not a human being is to be seen. What villages we do pass are composed of log huts. The line is carried over the Tobol and Irtish, feeders of the Ob, by fine bridges. At the latter spot, where the river is joined by the Om, stands **Omsk**, the capital of the steppes and the centre of the fertile black earth region, with corn stores, dairy farms, saw-mills and river steamers. The trunk line does not pass through **Tobolsk**, an important town

at the confluence of the Tobol and Irtish, because the meeting-place of these rivers is a region of swamps, across which no railroad can be built. The line continues along the steppes towards the Ob, which is crossed by a magnificent bridge over half a mile long. **Tomsk,** the most important town of Western Siberia, lies on a branch line on the Tom, a tributary of the Ob. After crossing the Tom, the line climbs along the lower spurs of a mountain range where the country is well-wooded (for here we enter the forest zone) and with fine pastures. The Yenisei is crossed at **Krasnoiarsk**, the centre of coal and iron mines, by another fine bridge, and then the line strikes south-east and climbs into more mountainous country. The small towns at which we stop are at spots where the railway crosses the rivers.

At last we reach the Angara and follow up its valley to **Irkutsk.** Here, after nine days' railway journey, the traveller finds himself in the capital of Eastern Siberia. Irkutsk is a fine town, and the largest city of Siberia, with fine straight streets, churches, museums, theatres, schools, fine shops and splendid government buildings. Proceeding up the Angara the line reaches Lake Baikal. Formerly passengers had to alight here and cross the lake, by ferry-boat in summer and by sledge over the ice in winter, but the line is now carried round the south-west corner of the lake. From Lake Baikal the route passes nearly eastwards through the Yablanoi Mountains, making use of the valleys wherever possible, bridges the two feeders of the Amur, pierces the Kinghan range by a tunnel over a mile long, and crosses the upper Manchurian plain. Here, at **Harbin**, it sends off an important branch southwards to Port Arthur and Pekin.

On leaving this plain it again has to climb a coast range before running down to the harbour of **Vladivostok**, its sea terminus on the Japan Sea. This port is the sea-outlet of the Siberian railway, exporting the timber of the forest belt and soya beans from Manchuria. Large quantities of tea and silk from China and Japan as well as manufactured goods shipped across the Pacific from the United States to Vladi-

vostok can be carried by this railway across Siberia to Europe. For several weeks in winter the harbour of Vladivostok, owing to the cold sea current, is blocked with ice. If we made this journey in the cold season, the rivers and streams we crossed would all be frozen and the ground would be covered with snow. Everyone would be wrapped up in thick furs or coats made of sheep-skin.

The Climate of different parts of Asia.—We have now studied the geography of Asia. Can we write down what we know about its climate? We can do this best by using a globe.

1. The continent lies wholly north of the equator. The Tropic of Cancer passes across its three main southern peninsulas. On places north of this line the sun at noon is never overhead, and he shines more and more slantingly as we go north. Siberia is never hot: in the cold months it is very, very cold.

2. Large parts of Asia are far from the sea and they are, therefore, much colder in the cold months and hotter in the hot months than they would be if they were on the coast. They have an extreme climate. In Tibet, in July, the sun is hot enough to dry up pools and streams; in January every drop of water is turned into ice.

3. The parts far from the sea are also very dry. Tibet and Mongolia, Turkestan, Persia and Afghanistan receive very little rain and large parts of them are desert. Arabia is separated from the great Sahara Desert of Africa by the narrow Red Sea. It can get no rain from Africa and is therefore also very dry. Asia Minor and Syria get a little rain from the Mediterranean but it falls in the cold months. Siberia is too far away from the Atlantic to get a share of the rain blown from that ocean across Europe. In summer it gets a little rain from the Arctic.

4. Large parts of Asia are high, *e.g.* the central high lands and the western table-lands. This makes them fairly cool in the hot months and very cold in the cold months. Snow lies on their highest ranges all the year round.

5. The monsoon lands receive heavy rains blown in from the warm Indian and Pacific Oceans in the hot months. In the cold months the monsoon winds blow in an opposite direction, out from the land, and then they are cool and dry. In Northern China, Manchuria and in the northmost parts of Japan, as these winds blow out from the snows of Mongolia and Siberia, they are very, very cold. The monsoon lands are the wettest and warmest parts of Asia. They, therefore, grow most of the food and contain most of the people. Outside of the monsoon lands only a very small part of Asia gets as much as 16 inches of rain, *i.e.* less than the driest parts of the Deccan.

Some of the Animals.—We have seen, or know about, most of the wild animals of India. They are found in those parts of the monsoon lands where they can live in safety. If we go out of the monsoon lands, we leave most of these animals behind. In the Himalayas the yak takes the place of the bullock. On the mountain ranges of Central Asia there are several kinds of wild sheep ; over the lower lands herds of deer and antelope wander. In the far north there are many fur-bearing animals (foxes, bears, squirrels) in the forest belt. The reindeer roams in summer over the moss of the tundra. It has been tamed to draw sledges. Polar bears, protected by their thick white coats, fish in the icy waters of the Arctic. Again, in the deserts there are wild camels, but most camels are tamed. The Arabian camel has one hump ; the Mongolian two, and its coat is much thicker. He needs it in the cold winter of his native place.

CHAPTER XLVIII.

THE CHIEF POLITICAL DIVISIONS OF ASIA.

(*See coloured map of Asia.*)

ASIA may be called the Mother Continent. In Asia men first learned to till the soil, tame animals, build cities, make laws, use writing and carry on trade. From Central Asia came the forefathers of the highly civilised races which now live in Europe, North America and large parts of South America and Australia. The Aryans who came to India had their home beyond the Himalayas. When the rest of the world was uncivilised there were great empires in Asia. Even now we can see the ruins of vast cities they have left in Persia and Mesopotamia. Asia, too, has been the birthplace of the great religions of mankind. Buddhism was born in India and has spread over Burma, Ceylon, Siam, China, Tibet and Japan. India is the home of Hinduism. The prophet Mohammed was born in Mecca and is buried in Medina. Jesus Christ, the founder of Christianity, lived, taught and was put to death in Palestine.

The Empire in Asia.—Great Britain has under her rule and guidance large parts of the continent. The **Indian Empire** includes Burma and part of Baluchistan. The peoples living in it are of different races, tongues and religions, but they are joined together under one government which keeps peace and order. It protects us from enemies and seeks to give us just laws, and to help the people to become good and prosperous citizens under the King-Emperor. **Ceylon** is another part of the Empire with a government of its own. **The Straits Settlements** and **the Protected Malay States** in the Malay Peninsula form another part. Singapore, the seaport at the

end of this peninsula, is the chief town. The island of **Cyprus** in the eastern Mediterranean, **Aden**, the fortified coaling station in the south-west of Arabia, **Hong Kong**, the island off the coast of China, and the northern part of the large **island of Borneo** are also under the protection of the British Empire and form part of it.

Russian Asia.—Till 1914 Russia ruled a large part of Asia—much larger than the Indian Empire. It included (1) **Siberia**, stretching right across the north of the continent; (2) **Russian Central Asia**, *i.e.* the country round the Caspian and Aral Seas; (3) **Transcaucasia**, *i.e.* the fertile isthmus between the Black Sea and the Caspian. Before the Great War the Russians were trying to develop this great empire by sending out colonists and giving them land for farms. They also built the trans-Siberian and trans-Caspian railways to increase its trade. As a result of the Great War, the Russian Empire has fallen to pieces. No one yet knows what parts of Asia will remain under Russian rule. The parts of the Russian Empire in Asia may become independent.

French Asia.—Pondicherry and a few other small places in India are under the protection of France, but her most important possession is French Indo-China, made up of the provinces of **Annam, Cambodia, Cochin-China** and **Tongking**. Hanoi and its port of Haiphong are the chief towns in Tonking, and Saigon the largest town and chief seaport of Cochin-China.

Dutch Asia.—Under the rule of Holland are several islands, of which **Sumatra, Java, Celebes, Sunda** and **the Spice Islands** are the most important. Batavia in Java is the chief town and port. The southern half of Borneo is also under Dutch rule.

Possessions of the United States.—As a result of the war with Spain in 1898 the United States took possession of the Philippine Islands, which formerly belonged to that country. Manila is the chief seaport.

Turkish Asia.—The Turkish, or Ottoman Empire, in Asia before the Great War included the whole of Asia Minor, Palestine, Syria, Mesopotamia and the coasts of Arabia bordering

the Red Sea, including the towns of Mecca and Medina. The Turkish Government became an ally of Germany during the war. When peace came, the Allies agreed that, owing to the weak government by Turkey of several of her provinces, they should be put under a different rule. By the treaty of peace with Turkey, Mesopotamia, Palestine, Syria and the Turkish part of Arabia were no longer to be under direct Turkish rule. Mesopotamia (Iraq) is recognised as an independent state with a king of its own, under the mandate of Great Britain. Syria is also recognised as an independent state under the mandate of France. Turkey gave up her sovereignty over Palestine, and most of the country was placed under the mandate of Great Britain, and part under that of France. The northern half of the Red Sea coast of Arabia, now known as the Kingdom of Hejaz, was made independent during the war. The Arabs, under the Emir, proclaimed their independence as they disliked the Turkish rule. By the peace treaty Turkey recognised the Hejaz as a free and independent state. This is important, because the Hejaz contains the holy places of Mecca and Medina and a large part of the railway running south to Medina. The King receives a subsidy from Great Britain to enable him to provide for pilgrims to these places. The country of Turkey now consists of two peninsulas. One of them is the small peninsula between the Black Sea on the one side and the Sea of Marmara and the Straits of Dardanelles on the other. This is the European part of Turkey, and its chief towns are Constantinople and Adrianople. The other is the large peninsula of Asia Minor, with the Black Sea on the north, the Aegean Sea on the west, and the Mediterranean Sea on the south. Its chief towns are Angora, the new capital, near the centre, Smyrna a port on the Aegean, and Trebizond, a port on the Black Sea.

Independent Asia.—**Persia** is ruled by its own Shah, whose capital is Teheran. The people are almost all Mohammedans. **Afghanistan** is an independent state under its Amir, whose capital is Kabul. **Siam** has a ruler of its own. Bangkok is his capital.

The Empire of China takes up about a quarter of Asia and is larger than the whole of Europe. It includes China Proper, much the most fertile and most densely peopled part, **Manchuria, Tibet** and **the Province of Sin-Kiang** lying between Mongolia in the north and Tibet in the south, and including Chinese Turkestan. In 1912 China, the oldest monarchy in the world, became a republic. China has only a very loose control over these provinces. The population of the Chinese Empire, if we can still call it an Empire, is thought to be about the same as that of the Indian Empire.

Mongolia, the indefinite tract of country including the Gobi Desert, is no longer part of the Chinese Empire, but most of the inhabitants are Chinese. The Emperor, who is a high Buddhist priest, has his capital at Urga.

Japan consists of four main islands and several small ones. The island of Formosa and the peninsula of Korea are now also under Japanese rule. The Marshall Islands in the Pacific, which formerly belonged to Germany, were transferred to Japan after the Great War. The Japanese Empire is one of the oldest in the world. The Emperor or Mikado has his capital at Tokyo.

CHAPTER XLIX.

EUROPE.

(See coloured map and Fig. 118).

We now come to Europe. Europe is really a large peninsula of Eurasia. In many ways it is a part of man's home very different from Asia. In the first place it is much smaller. Even India alone is more than half the size of Europe. Secondly, its coast-line is more broken, and only a small part of it is far from the ocean or some sea. Everything there seems to be on a smaller scale. The loftiest mountains are not so high as even the great tablelands of Asia; the plains are not so wide; the rivers are shorter, the peninsulas are smaller; so are the seas. In Europe, too, there are not such differences in climate as there are in Asia. The warmest parts are not nearly so hot as the hottest regions of Asia and the coldest parts are not nearly so cold. There are no hot rainy forests like those of Malabar or Burma or of the islands of the East Indies. Nor are there deserts like those of Central Asia, of Gobi, or of our own Thar.

But man has done more in Europe than in Asia. He has built finer cities with finer buildings; he has made better harbours and more of them; more roads, more railways. Railway lines convey goods and passengers from one end of the continent to the other. One can travel from Edinburgh or London to Constantinople in about three days. Man there has found out new ways of doing things, and he has made more use of steam and electricity. Even in agriculture he has learned to grow more plants to give him food, and he has tilled the soil more skilfully. On the whole, the peoples of Europe are better educated than those of Asia. There are more schools, colleges, libraries, museums and hospitals,

theatres and picture galleries. More books are printed and read; more letters are written. We must not judge everything by size alone nor by numbers alone. Though Europe is very much smaller than Asia and has fewer people living in it, in many ways it is a more important continent. If someone were to write a book telling the story of how man has made the earth, bit by bit, a more suitable dwelling place, the chapter describing Europe would be longer than that describing any other continent.

Helped by the many arms of the sea along their coasts, the peoples of Europe have become brave and skilful sailors. They have spread over the face of the world carrying their knowledge and skill with them—Greeks and Italians, Spaniards and Portuguese, Dutch and Germans, Frenchmen and Englishmen. They have crossed the Atlantic and made new homes there, so that we may say that North and South America are daughters of Europe. Australia is another daughter; so is New Zealand. India, too, would be a very different land if no Europeans had ever reached her shores; without the good government and protection she has enjoyed under their guidance; without the railways, harbours and irrigation works, schools and colleges they have taught her to make; without the vast sums of money she has borrowed from them to pay for these things. The day is coming when India will take her place among the greatest countries of the world, as she already is the greatest country in Asia. But we must not forget the help she has received from Europe to take that place.

Man has wandered to all ends of the earth, which is his home. Thus, one branch of the human family migrated across the mountains into Hindustan and then southwards into the Peninsula of India. Another branch passed westwards into Europe, and then crossed the Atlantic to the New World. But man is different from animals. In the first place he is always learning some new thing, and teaching it. He finds out more and more about his home, more and more skilfully he uses the things he finds in it and he makes better and nobler plans for the life he lives there. In the second place,

man helps his fellow man. If this were not so, the earth would not be a real home at all. One country helps another. Every nation has helped and been helped by others. What one discovers, or thinks, or plans, it tells to others. India has helped other countries and has been helped by them. One way in which nations help one another is by trade. Another is by letters, books and teachers. Another is by trying to stop quarrelling and fighting and to spread education, justice and peace. Indians are members of the League of Nations which seeks to carry on this good work. One Indian is a leader in this League. This work of helping is sometimes called Civilization. One way to learn about Civilization is to study Geography.

From Asia to Europe by Sea.—The gateway from Asia to Europe is by way of the Red Sea and the Suez Canal joining it to the Mediterranean. This long sea washes the southern shores of Europe. By crossing it we can reach the harbours of different European countries. Sailing a little west of north, past the west coast of Asia Minor, we enter the Aegean Sea, full of rocky islands. We might touch at Athens, the chief harbour of the mountainous country of Greece. The narrow Dardanelles Strait, between Asia Minor and the shore of Europe, leads us into the Marmara Sea, and at the other end we pass through the Bosporus Strait on which Constantinople, the capital of Turkey, stands. A train from Constantinople could take us north-westwards through mountains to the heart of the continent and by it we could reach any country. Leaving Constantinople behind, a two days' voyage would take us northwards across the deep Black Sea to Odessa, its chief harbour. The land behind Odessa is flat, and we could travel by river-steamers and canals into the middle of Russia. A quicker way would be to go by rail northwards to Moscow, in the centre of the country, from which other lines branch out in all directions.

If, instead of sailing up the Aegean, we steered farther to the west on leaving Port Said, in three days we could reach the harbour of Brindisi on the heel of Italy, and from it take a railway journey north. Or we might continue our voyage up the Adriatic Sea and land at Venice.

FIG. 116.—Railways, passes, and rivers leading out of Switzerland.
(The lightly dotted lines mark frontiers.)

Another way would be to sail through the strait between the island of Sicily and Italy and steer along the western coast of that country to Genoa, which is joined by rail to all the chief towns of Central Europe. Travelling by the mail steamer from India, we should, after leaving Port Said, make for Marseilles, the chief seaport of France, on the Lions Gulf, and a fast train would be waiting to carry letters and passengers to Paris and then on to London. If we preferred to go all the way by sea to London, we should have a voyage of over 3,000 miles westwards along the Mediterranean Sea, through the narrow strait of Gibraltar into the Atlantic, across the Bay of Biscay and up the English Channel.

Surface Features : Map Study.—We have already learned something about the build of Europe. The map shows that, just as in Asia, the high land is in the south and sends out peninsulas of high land southwards. Just as in Asia, too, the low lands are in the north (except the Scandinavian peninsula which is mountainous). This low land is so level that we can travel by train right across it from the Rhine to the Ural Mountains without passing through a single tunnel. The rivers flow slowly and are joined by canals so that there is much water traffic on them. The Mediterranean, the Black and Caspian Seas are deep, for here, long ages ago, the land sank. The North Sea, the Baltic Sea and the White Sea in the north are shallow, for here the ocean long ago flowed in and filled the low-lying parts. Most of Northern Europe was, at one time, covered with a deep ice-sheet, or glacier, which wore out hollows. When the ice melted, these hollows were filled with lakes. The map shows some large ones round the shores of the Baltic, but there are hundreds of others too small to be marked on the map. In order to learn the geography of Europe, we must study a good physical map and trace its high lands and its plains, its sea-coasts and its rivers, and then draw the map for ourselves. Another way is to imagine we have climbed up the highest part of the high land, from which we can see the surface of the country stretching away to the horizon in all directions.

FIG. 117.—A glacier coming from Mont Blanc into a valley.

The Alpine High Land : Switzerland.—Suppose we take our stand on the Alps. Switzerland occupies the northern and southern slopes of these mountains. They are the highest in

Europe. Mont Blanc, their highest peak, is just outside of Switzerland, between France and Italy. Switzerland is a small country—only about the size of the North-West Frontier Province of India, or about half the size of Mysore State. No part of it is less than 1,000 feet above sea-level and it is full of mountains and valleys along which rivers flow in all directions, fed by melting snows and passing through beautiful lakes. We might call it the Kashmir of Europe. The highest parts of these valleys are filled with glaciers. Lower down, where the heat is greater, these glaciers melt and streams flow out of them, just as happens in the Himalayas. These streams join together and form raging torrents, thundering over rocks and along steep valleys. The map shows that these mountain streams are the feeders of four of the most important rivers of Europe.

As there is so little flat ground in Switzerland, only a small part of it can be ploughed to grow crops. But the long damp valleys and the slopes of the mountains make splendid pasture land, so that large herds of cattle are bred. Swiss cheese is exported to all parts of Europe, and tins of condensed milk come even to India and Burma. On the slopes of the mountains grow fine forests, not of teak, but of beech and fir. Many of the houses, churches and bridges are built of timber, and the wood is also used for fuel, for there are no coal-mines in the Alps. The villagers carve the wood into clocks and toys which are sent abroad.

Although there are no coal-mines and iron-mines, yet Switzerland is a busy manufacturing country. The water-power of the country is used instead of coal. The swift mountain streams are made to turn saw-mills and make electricity, just as water-power is used in the Western Ghats, behind Bombay. Wherever we travel through the country, we see pipes carrying the rushing water to drive turbines. Raw silk and cotton are imported to be spun and woven in mills driven by electricity. Many of the railway lines are also worked by the same force. In return for the silk and cotton goods and the clocks and watches which they export, the

FIG. 118.—The Rhine flowing from Switzerland to the sea. The lightly dotted lines mark frontiers. What does the darkly dotted line mark ?

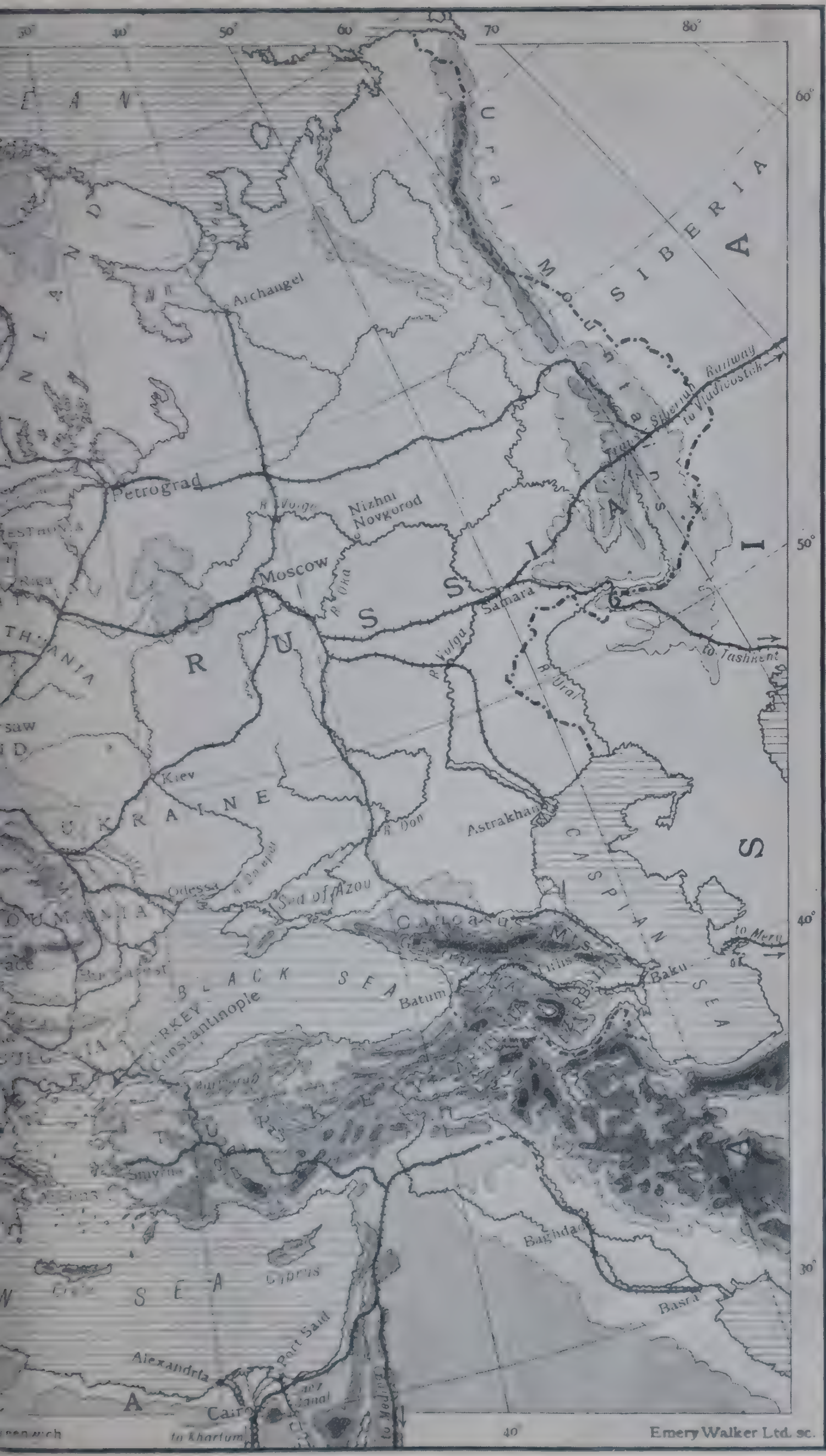
Swiss import a great deal of food, because their narrow, high-lying valleys can grow but few crops.

Switzerland has been called the Playground of Europe. Wherever there is a good view of the snowy peaks, of the glaciers, lakes and rivers, hotels have been built. Here rich visitors come from all the countries round about to enjoy the scenery. Some of them climb the high mountains with the help of native guides who know the way up the steep slopes of ice. The Swiss thus earn plenty of money from people who come to visit their beautiful country.

Owing to its many mountains, it is difficult to pass from one part to another or to trade by road with other countries. In winter the roads up the valleys are blocked by snow. But railways have now been built along most of the valleys and tunnels have been dug under the mountains. There are more tunnels in Switzerland than in any other country, so that now a great deal of trade passes through it from towns in Germany to seaports on the Mediterranean Sea.

Since so much of the land is mountainous and waste, the population is not large—less than forty lakhs—and there are few large towns. The south and west of Switzerland is taken up with lofty ranges of Alps, and here we find only villages in the valleys. On the west, the country is fenced off from France by the parallel ranges of the Jura Mountains. Between these mountains and the Alps stretches a broad valley with several lakes out of which flow rivers that feed the Rhine. Most of the larger towns are in or near this valley. **Berne**, the capital, lies in the middle of this plain. **Zurich**, on its lake, is a much larger town, manufacturing silk, and is a meeting-place of railways. **Basle** lies on the Rhine close to the point where it leaves Switzerland and enters Germany. It is thus the gateway of the Upper Rhine, leading into Switzerland, and an important railway centre. **Geneva** stands on the Rhone, where the river leaves the lake and enters France. It is the gateway of Switzerland leading down the Rhone valley to Marseilles. It is the meeting-place of the League of Nations.


EUROPE
English Miles
0 100 200 300 400 500
Principal Railways
ARCTIC
ICELAND
Arctic Circle
Faroe Is
Shetland Is
Orkney Is
Bergen
BRITISH
ISLES
SCOTLAND
Glasgow
Edinburgh
NORTH
SEA
Belfast
Dublin
IRELAND
Cork
Hull
Liverpool
Amsterdam
London
Dover
Plymouth
English Channel
Calais
Brussels
Bremen
Cologne
Havre
Paris
Orleans
Bay of
Biscay
FRANCE
Bordeaux
Lyons
Oporto
Lisbon
PORTUGAL
Madrid
SPAIN
Marseilles
Barcelona
Corsica
Rome
Sardinia
Cadiz
Seville
Straits of Gibraltar
Gibraltar
MEDITERRANEAN
ATLANTIC
OCEAN
AFRICA



Archangel
Petrograd
R. Volga
Nizhni Novgorod
Moscow
R. Oka
Samara
R U S S I A
Ural Mountains
SIBERIA
Trans-Siberian Railway
to Vladivostok
to Tashkent
R. Ural
Kiev
UKRAINE
Odessa
R. Don
Astrakhan
CASPIAN SEA
Caucasus Mts.
Tiflis
Baku
to Merv
BLACK SEA
Batum
Constantinople
Smyrna
Baghdad
Basra
Cyprus
Port Said
Alexandria
Cairo
to Khartum
Emery Walker Ltd. sc.

CHAPTER L.

I. THE RHINE—GERMANY, HOLLAND AND BELGIUM.

JUST like the Himalayas, the Alps are the birthplace of many rivers, and just as we can understand the geography of Northern India by following the courses of the Brahmaputra, the Ganges and the Indus, so we can learn part of the geography of Europe by following the rivers that rise in or near the Alps and flow in different directions to the sea.

We begin with the Rhine. This river drains the Alps along their northern valleys. A good map shows that in Switzerland four rivers join together to form it, and they flow through many beautiful lakes. The main river flows through Lake Constance, which lies between Switzerland and Germany. It then turns west, dividing these two countries, and at Basle it takes a turn northwards. It here enters a broad and very fertile valley between French mountains on its left bank and German mountains on its right. The fertility of the valley is due to the mud which the river has brought down from the Alps for thousands of years. The crops, however, are quite different from ours. The fields grow wheat, rye and oats, and there are many fruit trees. On the valley slopes are vineyards and from their grapes wine is made. Above the vines are pastures and above these are the forests. The swift streams rushing down their narrow valleys to join the Rhine are used to drive saw-mills, which cut up the trees of the forests into useful timber.

As we sail down the Rhine, we see hundreds of barges and small steamers, for the river is the greatest waterway of Europe and carries more traffic than the Ganges or even the Yangtse

Photo. The [illegible] Co.

FIG. 120.—The Rhine in Germany

Kiang. No other river has so many ports and towns along its banks and those of its feeders. Fig. 118 shows some of these towns. **Mulhausen** and **Kolmar,** on a left bank feeder, now belong to France as a result of the Great War. **Mannheim** and **Mainz** are river ports trading in coal and timber. **Frankfurt** on the Main is a large banking centre, and farther up this river stands **Nuremberg**, where German toys are made. Many of them come to India. **Coblenz,** which means the *Prayag*, or meeting-place, stands farther down, at the spot where a river flowing from French hills meets the Rhine. As we sail down, the river valley becomes wider and flatter, and we see the towers of the cathedral of **Cologne,** one of the largest towns of Germany, and the most important port on the river. It is also a manufacturing town, for it is near a coal-field. During the war thousands of trains carried German soldiers across the Cologne bridge on their way to France. The Rhine has now left the high land behind and entered the great plain of Northern Europe.

Below Cologne the Rhine is joined by the Ruhr on its right bank. In the valley of this feeder is the richest coal-field in Europe, and here we see the smoke of many manufacturing towns making linen, cotton and woollen goods, iron and glass. Their names are on the map. **Essen** is noted for its iron works where guns, armour-plate for warships, and machinery were made before the war. The Allies have forbidden any more guns to be made. Leaving the smoke of these busy towns behind, the river flows out of Germany and, turning westwards, enters its flat delta.

Holland.—This small country, inhabited by the Dutch, is the delta of the Rhine. It is, therefore, very flat and the deep soil is very fertile. But the flatness makes the country marshy and some of it is below sea-level. The Dutch, therefore, have always had to fight against water. They have had to drain their land by canals and pump the fresh water from the land into the sea. They have had to fight with salt water too, and have built high banks along the coast to keep the sea from drowning the land. Wind-mills with huge arms are seen

Photo. Topical Press Agency.

FIG. 121.—Cologne on the Rhine.

everywhere pumping water into the canals. Holland is, therefore, a country of flat fields and meadows crossed everywhere by canals. Boats take the place of carts. Holland means Flat Land ; it is sometimes called the Netherlands.

The soil of the delta is fertile, especially the low-lying parts which have been tilled for centuries. The soil is also naturally moist, and therefore suited for growing rich pasture grasses. Everywhere we see herds of black-and-white cattle. Enormous quantities of Dutch butter and cheese are exported, both across the sea to Britain and to countries inland. Wheat, potatoes and sugar-beet are the chief crops. Holland is a land of farms. As in other deltas, there are no coal-mines, so that there are few manufactures. Holland has for hundreds of years been a great trading country. After the sea-route to India and the East was discovered, the sea-trade of Holland greatly increased, because the waterway of the Rhine was the easiest way for foreign goods to be brought to central Europe. At one time the Dutch were the greatest sea-trading people in the world, and in 1602 the Dutch East India Company was founded, trading with seaports in India. Of the present Dutch colonies Sumatra and Java are the most important.

Amsterdam, the capital, is built on islands near the shore of the Zuider Zee (Sea) which is too shallow for large ships. The harbour has, therefore, been joined to the North Sea by a deep ship canal. Besides being an important seaport, Amsterdam prepares the tobacco, cacao, sugar, quinine and coffee brought from the Dutch colonies. **Rotterdam** stands on one of the mouths of the Rhine, and is the port of that river and its valley. It is a river-port joined to the sea by a ship-canal and imports the products of the Dutch colonies. Owing to its position, a great deal of German export and import trade passes through it.

Belgium, another small country with a short, low-lying coast, lies south of Holland. As in Holland, there is much rich, flat meadow-land, which is partly used as pasture and partly ploughed up for fields. These grow wheat, rye, sugar-beet and flax (linseed), which is the most valuable crop. The

FIG. 122.—Flat Holland and Belgium.

water of the rivers is excellent for bleaching flax. From it fine linen and lace are made in **Ghent** and other smaller towns. But, unlike Holland, the country, on the side next to France, has rich coal-fields, and so it has large manufactures, and the population is denser than in any other European country. At **Liège** fire-arms, steel rails, machinery and glass are manufactured. Many of our bridges in India are built of iron made in Belgium. The flatness of the country has allowed roads, canals, and railways to be cheaply built, so that trade can be easily carried on with the neighbouring countries. It was owing to the flatness of Belgium, which gave an easy passage for armies into the north of France, that the Germans, in 1914, broke the treaty and invaded Belgium. They destroyed some of its towns and villages and ill-treated or killed many of its people. To save themselves, the Belgians broke down the sea-dikes and flooded part of their country.

Brussels, the capital, is a very old town, from which railways run in all directions. The chief port is **Antwerp**, on a river which flows into the Rhine delta. We might compare it with Calcutta. It lies at the head of a deep estuary, up which sea-going vessels, helped by the tide, can come. Like Calcutta, too, it is connected by a network of waterways and canals. These join it to the Rhine and the Seine. The country behind it is flat, so that it is joined by railways to large manufacturing towns in Germany. In fact, a great deal of German trade—both exports and imports—is carried through Antwerp. It is one of the most important seaports of Europe, and carries on a large trade across the Atlantic.

II. GERMANY, POLAND AND DENMARK.

Germany.—We have already studied the western part of Germany through which the Rhine flows. The other rivers flowing northwards through Germany do not rise in the Alps, but in the forested mountains north of the Alps, and they enter either the North Sea or the Baltic. Germany is made up of these mountains, their valleys in the south and the wide flat

plains in the north. Trace on the map the course of the Ems, the Weser, the Elbe and the Oder. They have all been deepened to allow small steamers and barges to carry goods to and from the coast. Most people in India have heard of the *Emden*, the German warship which, during the war, fired shots into Madras harbour. She was called after the port of **Emden** on the Ems. **Bremen** is a large river-port and seaport on the Weser. It carries on a busy trade with India. The Elbe flows north-westwards, right across the country, and is another important waterway. Down it are floated the logs of timber cut in the forests of the southern high land. Soon after entering Germany it passes **Dresden**, the chief town of Saxony, a fertile and prosperous part of the country. Coal and iron are mined near at hand and wool is got from the sheep fed on the hills. Saxony is, therefore, famed for fine woollen cloth. After passing through other towns, the Elbe reaches its estuary, sixty miles from the sea, and here stands **Hamburg**, the chief seaport of Germany. Before the war it carried on sea-trade with all parts of the world. In those days one could always see steamers from Hamburg in Karachi, Bombay, Colombo, Madras, Calcutta and Rangoon harbours. They brought us German manufactured goods and took back cargoes of rice, hides, oil-seeds and copra. On the Oder stands **Stettin**, a port trading with Baltic harbours. On a small feeder of the Elbe, and joined to the Oder by a canal, lies **Berlin** the capital. Its position in the middle of the wide, flat plain of Northern Germany has made it an important railway centre. The map shows lines spreading out from it to the Baltic seaports, to Amsterdam and Antwerp in the west, across the Rhine to the chief towns of France, southwards by valleys in the southern high land into Switzerland and then through tunnels under the Alps into Italy, as well as eastwards into Poland and Russia. It is a fine city full of factories, and with famous colleges and schools, for the Germans, more than any other nation, have paid attention to education. On the line running south from Berlin to Switzerland we pass through **Leipzig**, one of the busiest towns,

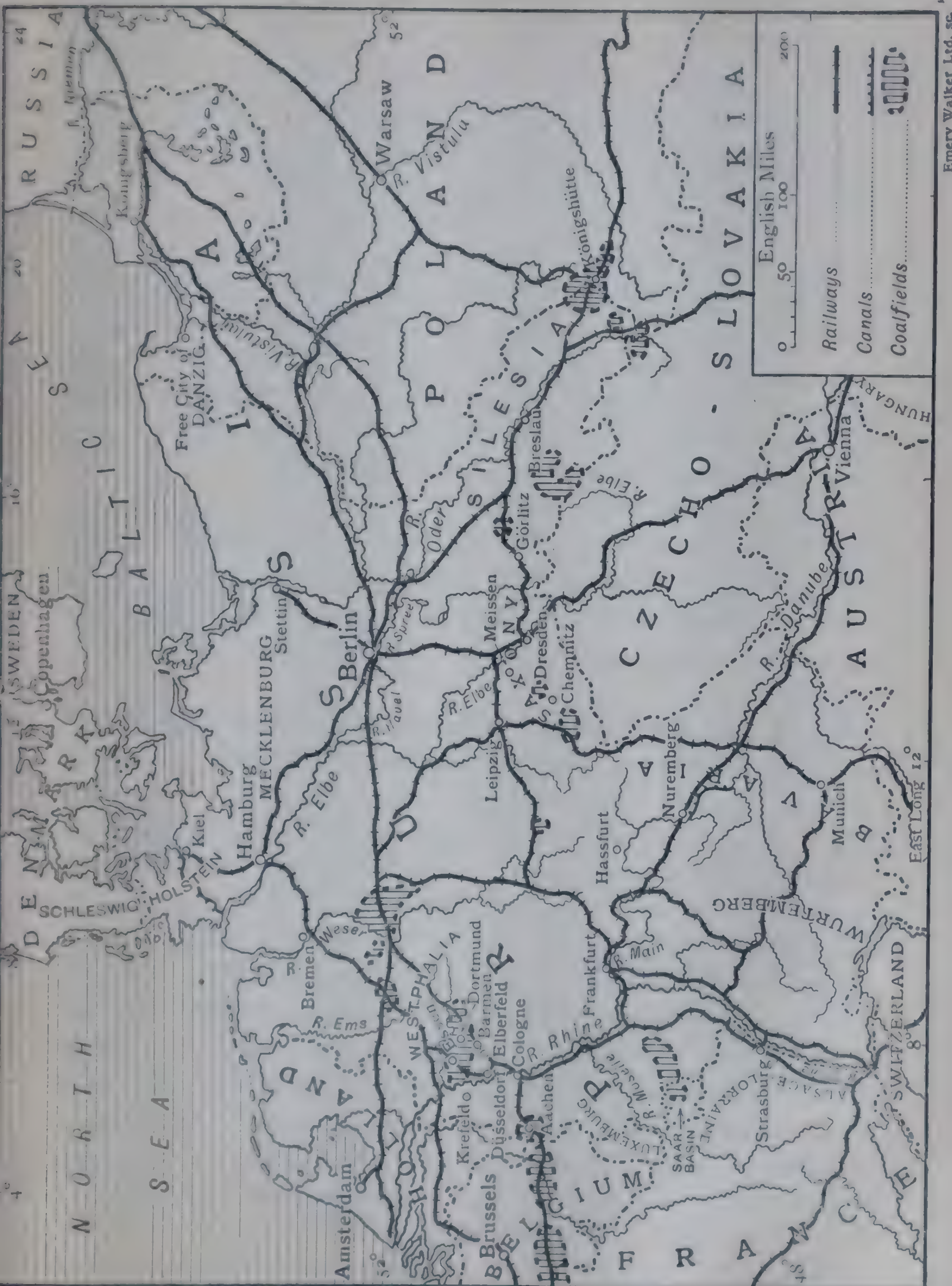


FIG. 123.—Central Europe—Towns and railways.

where most of the books published in Germany are printed, and **Munich**, full of breweries and next in size to Berlin and Cologne. These are only a few of the most important cities. There are more than thirty with over a lakh of inhabitants.

Germany is a busy manufacturing country, for it has good coal-fields, and iron, zinc, copper and lead mines. Iron and steel goods, cotton and woollen cloth, glass, leather and electric machinery are made in many towns. The Germans make more chemicals than any other people and they excel all others in the manufacture of dyes. Large quantities of German dyes come to India. Germany before the war built many large ships at Hamburg, Stettin and Kiel. **The Kiel Canal**, dug between the Baltic and the estuary of the Elbe, gives a quick passage for ships between the two seas.

Since the Great War Germany has lost all her colonies and a great deal of her trade. She has also been made to give up some provinces which she had taken from France, from Denmark and from Poland, so that her territory and population are smaller than before the war. The Government is now a republic.

Poland and the Vistula : Poland, which takes up part of the Great Plain lying between Germany and Russia, has, since the war, become once more an independent state, but the people are not of one blood and they do not all speak the same language. Before the war part of Poland belonged to Germany, part to Austria and part to Russia. Most of the country is flat, but in the south the border touches the slopes of the Carpathian Mountains. From these mountains the Vistula flows in a great curve across the flat plain of Poland, into the Baltic. Poland occupies the basin of the river. The chief crops are the same as those of Germany, namely, wheat, rye, barley, sugar-beet and potatoes. Like Germany, too, Poland has mines of coal, iron, zinc and salt. The capital is **Warsaw**, on the Vistula, a large manufacturing town and, like Berlin, the meeting-place of railway lines.

Denmark is another country bordering Germany. It is made up of a small and very flat peninsula and several small

islands, stretching north between the North Sea and the Baltic—altogether about half the area of Mysore State. Besides being very flat, the country is in many places marshy and sandy. The Danes, like the Dutch, have drained their marshes and turned them into pastures. Denmark is, therefore, like Holland, an agricultural country where the farmers grow crops of oats, barley, rye and potatoes, and breed cattle. Butter is very largely made and is sent abroad. Some of it comes in tins to India, Burma and Ceylon. Butter, eggs and bacon are sent across to Great Britain, which sends in exchange coal, cotton and woollen goods, for there are no mines and few factories in the country. The Danes, living on a peninsula and islands, have always been good fishermen and sailors. The capital, **Copenhagen**, which means ' Merchants' Harbour,' is the largest port, and stands on an island on the Sound, a strait leading into the Baltic. It is the only harbour in Denmark deep enough for large steamers and its position makes it an important seaport. Most of the trade is carried on with British, German and Swedish ports.

Many years ago Danish seamen crossed the sea and took possession of **Iceland**, the large island in the Arctic Ocean, and the group of **Faroes Islands**. Iceland is full of volcanoes, some of which are still active but most dead. They are covered with snow and ice. The climate is too cold for corn to be grown. But in the short, warm months the grass of the valleys feeds cattle, sheep and small ponies. Many of the people fish in the sea and hunt birds. In such a cold and unfertile land there are only a few inhabitants—less than a lakh altogether. **Greenland** is a colony of Denmark. It is as large as Assam, but it is mostly covered with ice and has only a few thousand inhabitants who live in fishing villages.

CHAPTER LI.

THE RHONE AND THE PO.

The Rhone and France.—Now let us come back to the Alps and trace another of the rivers that are born there. This is the Rhone. It flows out of a glacier quite close to the birthplace of its sister, the Rhine, but it takes us, not to the North Sea, but to the warm Mediterranean. First it flows through the beautiful Lake of Geneva lying in an Alpine valley. All round are Alps, and we can see the snowy top of Mont Blanc, their highest peak. After leaving the lake, the Rhone is a French river all the way to the sea. It has first to cut its way down between steep mountains to its lower valley. There it meets its sister river, the Saone, flowing from the north. At the meeting-place stands **Lyons**, one of the largest towns of France. It manufactures silk on a large scale. The silkworms are fed on mulberry leaves growing in the warm Rhone valley. The spinning and weaving machines can be driven by the force of the river, and its water is very suitable for dyeing the silk. Much French silk comes to India from Lyons and the towns round it.

Leaving Lyons behind, the river flows nearly south, through a narrow but fertile valley to the Gulf of Lions. Its slopes are covered with vineyards, and we are now in one of the chief wine-making parts of France, which is the greatest wine-producing country in the world. As we go down the Rhone, we feel we are coming into a warmer land. The map shows this long valley separates the high mountainous Alpine part of France on its left bank from a table-land on its right bank. This table-

land slopes down to the north and west and sends rivers into the Bay of Biscay.

Fig. 124.—The Rhone flowing out of a glacier in the Alps.

The Rhone valley is important because it is the chief gateway for roads, railways and canals from the Mediterranean to the

north and centre of France. At the sea-end of this gateway, on the eastern edge of the Rhone delta in a sheltered bay surrounded by hills, stands **Marseilles**, the chief seaport of France. The position of Marseilles tells us its trade is chiefly with the Mediterranean ports and the East, and this trade was greatly benefited by the opening of the Suez Canal. In its harbour we are sure to see large steamers either arriving from, or leaving for, Bombay, Calcutta, Madras and Rangoon. As we walk along its docks and streets, we smell oil, for there are large factories refining olive oil brought from the Mediterranean coasts and making soap and a kind of butter from oil-seeds which have come from Pondicherry and other Eastern ports. The mail steamers from London to and from Bombay stop here, and many passengers, instead of going round by the Straits of Gibraltar, get on board or leave the steamer here and travel by rail along the Rhone valley through Paris and Calais.

Other French Rivers.—Just as Germany lies between the Alps in the south and the Baltic and North Sea in the north, so France lies between the Alps and the Jura Mountains in the east and the Bay of Biscay and the English Channel in the west. Just like Germany, France is crossed by several rivers, and by tracing them on the map we can understand the geography of the country. The most important are the Garonne, the Loire and the Seine, and they have many feeders. These rivers do not rise in the Alps but in the Pyrenees, the central table-land of France, or the high land lying west of the long Rhone valley. The Garonne and its many feeders water some of the richest districts of the country. Fields of wheat and maize, vineyards and gardens growing fruit and vegetables are seen everywhere. **Bordeaux** lies on the long estuary of the river, and is the chief wine-exporting seaport of France. Thousands of barrels of wine are shipped from it every year. The Loire rises far south in the central table-land, and in its long course, first north and then west, receives many feeders. They flow through very fertile valleys and plains which have been called the Garden of France. Every acre

is cultivated, and wheat, vines, sugar-beet and fruit are the chief crops. The climate is warm and not dry like the Mediterranean coast, for the warm winds from the Atlantic bring

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FIG. 125.—The Highlands and Lowlands of France.

plenty of rain. **Orleans** is the chief town on the river and its seaport is **Nantes**. In this part of France there are few manufactures, for there are no coal-fields near.

Nearly all the northern part of France is drained by the Seine and its feeders. As they flow through a low-lying and level plain, their currents are slow, and they are, therefore, much used by boats, barges and river-steamers. They are also joined by canals with the Rhone, the Rhine and the canals of Belgium. The Seine is the most important river of France. About half-way down its course stands **Paris**, the capital. Almost all the important railways and many of the roads of France meet in Paris, and the Seine is navigable by small steamers down to the sea. Paris is the great pleasure city of Europe, full of splendid streets and shops, colleges, museums, theatres and public parks. People from all parts of the world come here to buy silk and lace, jewels, pictures, furniture and other beautiful things. The French make them better than any other people in Europe. In the Great War German armies invaded Belgium and Northern France and destroyed many of the towns, but they could not reach Paris. They were driven back at the battle of the Marne River, which flows into the Seine close to the city.

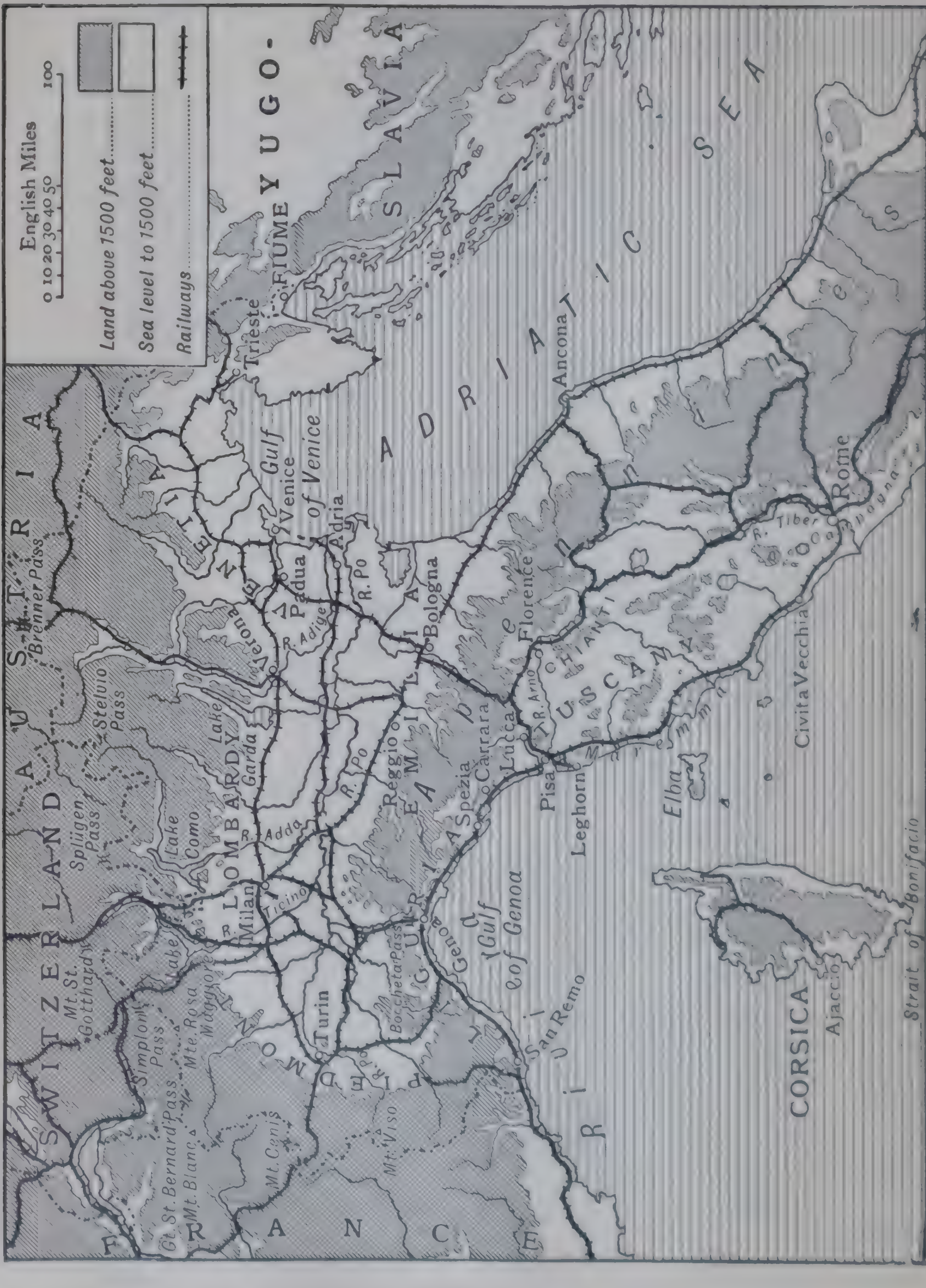
Sailing down the Seine we come to **Rouen**, a river port which can be reached by sea-going vessels, where there are many cotton factories. It is, therefore, often called the 'Manchester' of France. At the mouth of the Seine we come to **Havre**, which imports cotton and tobacco from the United States and coffee from Brazil, for every Frenchman drinks coffee at least once a day. If we sailed northwards along the coast, we should pass **Dieppe, Boulogne** and **Calais**. From these four seaports steamers carry passengers and goods to harbours on the opposite English coast. The passage from Calais to Dover is the shortest. The mail letters between London and Bombay go by this route and then through Paris to Marseilles, where they are put on the steamer that takes them through the Suez Canal. In the Great War these four ports were the landing-places of British troops who came to help France against Germany. The American troops from New York landed at **Brest**, the most westerly port. The Indian troops landed at Marseilles. Inland from Calais lies a coal-field

which stretches into Belgium. On it are many manufacturing towns, of which **Lille** is the chief. It weaves cotton and woollen cloth.

These are only a few of the towns of France. A good map shows many more. The area of the country is about the same as that of the United Provinces, but the population is smaller and much less dense. As a result of the war, Germany gave back to France two provinces on the left bank of the Rhine, so that for over a hundred miles that river is now the boundary between the two countries. The chief town here is **Strasbourg,** a fortress city and a port on the river.

The Po and Italy.—We return once more to our starting place in the Alps, to follow another river to the sea. This is the Po, which drains the steep southern slopes of the Alps into the fertile Lombardy plain of Italy. This river reminds us a little of the Ganges on a small scale. Just like that river, the Po receives most of its feeders coming from mountain valleys on its left bank. Some of them flow out of beautiful mountain lakes. The valleys of these feeders coming from the Alps are the paths by which railway lines pass from Italy into the neighbouring countries of Europe. When they can climb up these valleys no farther, they pass under the Alps by long tunnels. A mail train takes twenty minutes to go through some of these tunnels.

The Lombardy plain of Italy, along which the Po flows, is very flat. It has been built up of the mud brought down from the mountains by the river. Unlike the plain of the Ganges, it receives little rain and canals have been dug to water its fields. All along the Mediterranean coasts the summers are warm and almost rainless, so that, just as in India, man must store up water to irrigate his fields. We know at once we are in a warmer country than we came to when we followed the Rhine down the northern slopes. One reason is that this plain is shielded from the cold north by the high wall of the Alps. On the slopes of the hills are vines and sweet chestnuts. In the plain even rice can grow in summer in the flooded fields. Wheat is the largest crop. The climate is warm


English Miles
0 10 20 30 40 50 100
Land above 1500 feet
Sea level to 1500 feet
Railways
YUGO-SLAVIA
FIUME
Trieste
AUSTRIA
Brenner Pass
SWITZERLAND
Splügen Pass
Stelvio Pass
Mt. St. Gotthard
Simplon Pass
Mte. Rosa
Gt. St. Bernard Pass
Mt. Blanc
Mt. Cenis
Mt. Viso
FRANCE
VENETIA
Venice
Gulf of Venice
Padua
Adria
Verona
R. Adige
Lake Garda
Lake Como
Lake Maggiore
LOMBARDY
Milan
R. Adda
R. Ticino
PIEDMONT
Turin
Bocchetta Pass
LIGURIA
Genoa
Gulf of Genoa
San Remo
R. Po
EMILIA
Reggio
Bologna
Spezia
Carrara
Lucca
Pisa
Leghorn
Florence
R. Arno
CHIANTI
TUSCANY
Elba
Civita Vecchia
R. Tiber
Rome
Campagna
Ancona
ADRIATIC SEA
CORSICA
Ajaccio
Strait of Bonifacio

enough to ripen maize, which is the chief food of Italy. These plants need hot summers. Everywhere we see mulberry trees. The silkworm feeds on their leaves and many towns manufacture silk. Italy produces more silk than any other country in Europe and this silk is the best in the world. There are many towns in this fertile plain. **Turin, Milan,** and **Venice** are the most important. Turin stands far up the Po valley. It is the starting place for the railway line across the Alps into France. From Milan, the chief manufacturing town in Italy, near the centre of the plain, starts the railway that crosses the Alps into Switzerland. The Po, like our rivers, is building up a delta at its mouth. North of this delta stands Venice, a seaport built on one hundred islands. Long ago the Venetians were noted for their ships and sailors, who brought the products of India from Alexandria and sent them across the passes of the Alps into central Europe. Venice, like many Italian cities, has many fine buildings. They were built by her merchants when Venice was the chief seaport and market of the Mediterranean. Its streets are noiseless and dustless, for they are canals; boats take the place of carts. A Kashmiri would say it is like Srinagar.

Italy is a long peninsula shaped like a man's leg. The Apennine mountains run down this leg and end in the rocky island of Sicily. Their slopes are covered with chestnut trees. The people grind the nuts of these trees into flour and bake it into a kind of bread. As the summers are dry, the grazing is poor and there are few cows. The peasants feed a few sheep and goats.

From the long coastline of Italy we should expect to find several seaports. We have already learned about Venice. On the opposite side of the Adriatic Sea is **Trieste**, another fine port, which, before the war, belonged to Austria. Steamers sail from this port to Indian harbours. On the other side of the peninsula stands **Genoa**, the chief port of Italy. Since tunnels were bored through the Alps behind it, Genoa has become the outlet for a great deal of goods and passenger

traffic by rail from northern and central Europe, and then by steamer through the Suez Canal to India, Burma, China and Japan. Genoa also carries on a large trade with America, through the Straits of Gibraltar across the Atlantic. Farther south is another harbour, and from this we can pass up the valley of a river to **Florence**, which is one of the finest cities in Europe. Many of its buildings are made of marble dug out of the Apennines. They remind an Indian visitor of Agra and Delhi. It has also famous picture-galleries and libraries. Still farther south, we come to **Naples**, another important seaport. Above it rises the smoking volcano of Vesuvius.

The capital and largest town of Italy is **Rome**. It stands on the Tiber, a river running down the west slope of the Apennines, but it is not a seaport. It is built on seven hills and is a splendid city, full of fine buildings. The cathedral of St. Peter is the largest Christian church in the world. Rome is often called the "Eternal City," because it has lasted for so many hundreds of years. Long ago it was the capital of the Roman Empire which governed all the countries round the Mediterranean Sea. We might call it the Delhi of Southern Europe. We can notice one more seaport, **Brindisi**, near the heel of Italy. It is the nearest Italian harbour to the Suez Canal, and the quickest way to reach London from India or Burma is to cross the Mediterranean to it from Port Said and then take train on the line which runs first along the low flat east coast and then north-westwards across the great plain to Turin. Another train takes us across the Alps to Paris and on to Calais, where we cross the Dover Strait and so on to London. By this overland route the European part of our journey to London is shorter by ten days than if we go all the way by sea through the Straits of Gibraltar.

Italy is not a very fertile country as a whole. It gets only a fraction of the rainfall of India. The grape, olive, mulberry, chestnuts, wheat and maize are the chief products. Owing to want of coal-mines Italy is, like India, handicapped in manufactures. Sicily is a mountainous island and has the same climate and crops as the mainland. There are rocky hills and

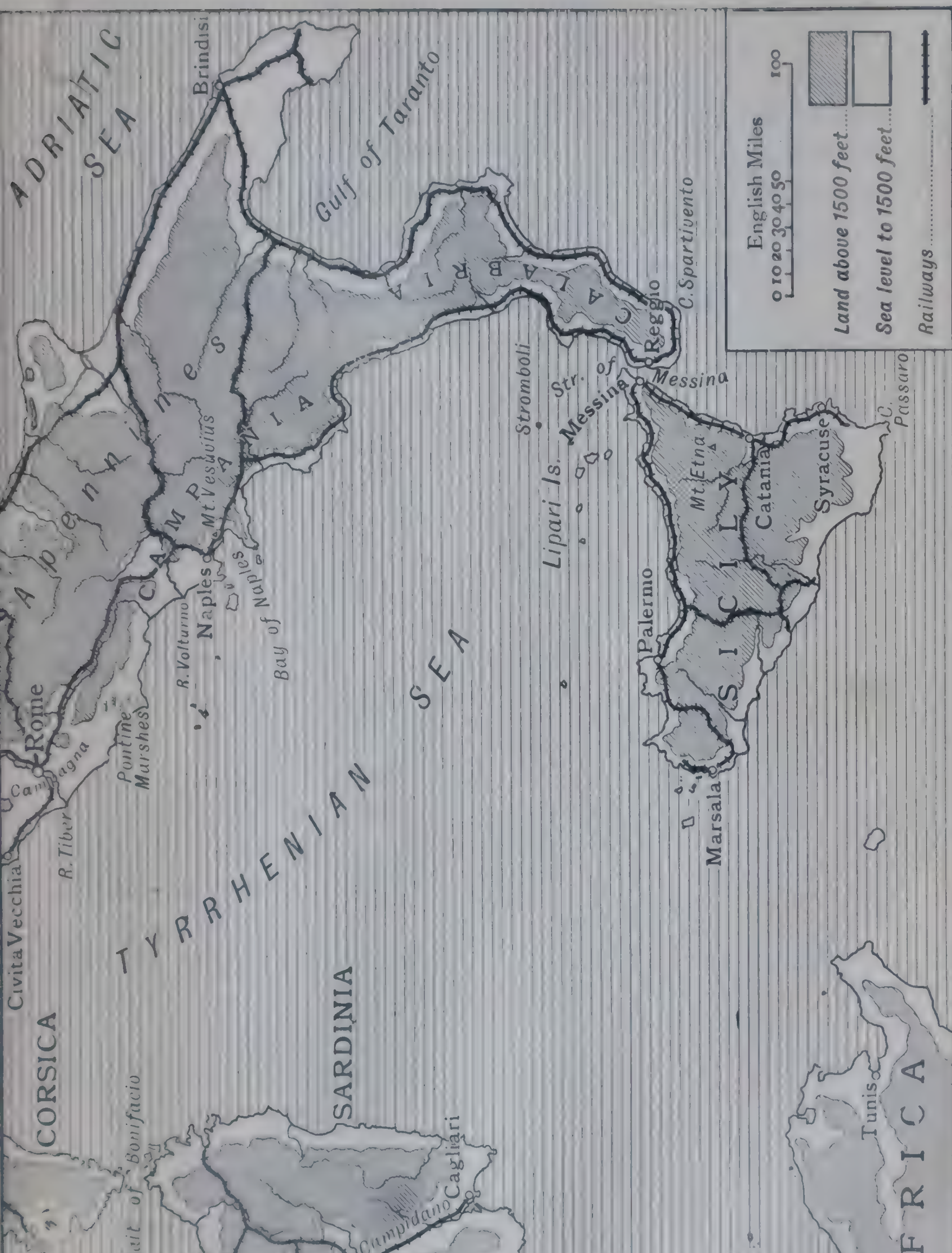


FIG. 127.—Southern Italy.

a little pasture for sheep and goats. The valleys running down to the sea are fertile, and in them we find the towns and villages. The great volcano of Etna rises nearly two miles high above the narrow strait. Large quantities of sulphur are obtained from it. Sardinia, another large rocky island in this sea, belongs to Italy. Corsica belongs to France. Mail steamers to India pass through the straits separating these islands and the strait between Sicily and the mainland. They often call at the harbour of Malta, an isiand belonging to Great Britain, where warships are stationed.

CHAPTER LII.

THE COUNTRIES OF THE DANUBE.

THE last of the great rivers fed by streams from the Alps is the Danube, which is the chief waterway of the middle and east of Europe. It is about twice as long as the Ganges. The main river does not rise in the Alps, but it receives feeders from these mountains on its right bank and from the Carpathians on its left bank. It is navigable for small steamers nearly all the way and carries a great deal of trade to and from the Black Sea. A good map shows it flows eastwards through southern Germany, then across northern Austria, where it passes the capital, **Vienna**. This town, being near mines and not far from the forested mountains, has large manufactures of metal goods, furniture, leather, wood-pulp and paper. It lies in a valley from which other valleys lead in different directions. This position makes it a meeting-place of many railway lines leading to other countries. Leaving Vienna, the river forms the boundary between Czecho-Slovakia and Hungary, which before the war formed, along with Austria, the Kingdom of Austria-Hungary. It then turns south and for 200 miles flows across the great plain of Hungary, lying between the curve of the forested Carpathians in the north and east and the Dinaric branch of the Alps, running along the eastern shore of the Adriatic, on the west. Here it passes between the twin towns of **Buda** and **Pest**, the capital of Hungary. In the plain it receives large feeders on either bank. At the point where one of these feeders enters it from the west stands **Belgrade**, the capital of Serbia, which is part of the new country of Yugo-Slavia, formed after the war. Turning eastwards once

FIG. 128.—Mountains and valleys of the Balkan Peninsula.

more, it forms the boundary between Roumania on its left bank and Bulgaria on its right, along the broad plain which lies between the Balkan Mountains on the south and the Transylvanian Alps in the north. Then it bends northwards into Roumania and enters the Black Sea in a large flat delta. This fine river is thus the chief waterway of Central Europe to the east, just as the Rhine is a waterway to the north. It is proposed to dig a canal joining these two rivers and thus to join the North Sea with the Black Sea.

The wide plains along which this great river flows are one of the chief wheat-growing regions of the world. Though the winters are cold, the climate is warm and dry in summer, for the surrounding mountains keep off rain-clouds coming from the sea. This is just the climate that ripens wheat best. The dry climate also helps the grinding of the wheat into flour. Maize is also widely grown. These crops are shipped down to the Black Sea and sent in steamers to other parts of Europe. The poor parts of the plains are taken up with pasture-lands. Vineyards and fruit-gardens are seen all over them, and vineyards as well as forests cover the mountain slopes which surround the plains.

The Balkan Peninsula.—South of the Danube stretches the Balkan Peninsula, divided into Yugo-Slavia, Bulgaria, Albania, Greece and a part of Turkey. Most of this peninsula is high and rocky. Some parts are covered with grass where sheep and goats are pastured. Others are covered with forests. The hilly Balkan Peninsula is quite unlike the flat fertile plains of the Danube. There are only a few towns. Only in small valleys coming down to the coast can crops of wheat and maize be grown. Here the fields can be watered from the small rivers. South of the Balkan Mountains the summers are hot enough to grow cotton and even rice. Mulberry trees, olives, and vines are cultivated everywhere, and round each village we see gardens full of fruit-trees. We feel we are near the warm shores of the Mediterranean once more. In such a thinly peopled land there are few railways, and these follow the river-valleys through the mountains. The chief line runs

FIG. 129.—The Danube at Budapest.

Photo. F.N.A.

along valleys and across passes from Belgrade to Constantinople. It passes through **Sofia**, the capital of Bulgaria. A branch from this line passes south along narrow valleys to **Salonika**, a busy Greek port.

Constantinople, or **Stamboul,** the former capital of Turkey, stands on the Bosporus, the narrow strait joining the Sea of Marmara with the Black Sea and dividing Europe from Asia. Part of the city is built on the Asiatic side of the strait where the railway across Asia Minor begins. We can see how important the position of Constantinople is, as it forms a kind of bridge between the two continents. Formerly Turkey ruled the whole of the Balkan peninsula, but several states have become independent.

Greece takes up the southern part of the peninsula. Notice what a long coastline it has. It is a country of rocky mountains, small plains, deep bays and mountainous islands. Greece is too dry to be very fertile. A great deal of the rocky mountains is only fit for pasture. Wheat and maize are grown in the narrow valleys. The vine is the most important plant. The very small grapes, called currants, are dried and sent abroad to all parts of the world. Tobacco from which cigarettes are made is largely grown. Much is exported to Egypt to make "Egyptian" cigarettes. The Greeks are famous sailors. It is difficult to make roads across the mountains. It is easier to go from place to place by water. The islands and bays round their coasts have taught them to love the sea. Greek steamers do a great deal of the sea-trade of the Mediterranean in currants, wine, oil, tobacco and figs. Greek merchants do business in London, Marseilles, Port Said and Bombay. The capital and chief port is **Athens,** built round a hill on which is a famous old temple. It stands near the narrow isthmus joining the southern peninsula to the mainland. In days long gone by Athens was the centre of the learned world. She has taught the world more than any other city.

Our journeys down the Rhine, the Rhone, the Po and the Danube have taken us to many parts of Europe. We have still, however, to visit the vast land of Russia in the east, the Iberian and Scandinavian peninsulas and the British Isles.

Photo. E.N.A.

FIG. 130.—Constantinople.

CHAPTER LIII.

RUSSIA AND ITS RIVERS.

RUSSIA takes up about half of Europe. Since the Great War, as a new map shows, four states bordering the Baltic Sea (Finland, Esthonia, Latvia and Lithuania) have claimed independence. But Russia is still the largest country of the continent. It is really a part of the Great Plain which stretches across the north of Eurasia. The only mountains are the long low ridge of the Urals stretching north and south on the eastern border and the lofty Caucasus Mountains in the south, running between the Black Sea and the Caspian. The rest of Russia is flat, and no part is half the height of our Western Ghats. Across this level plain rivers flow in different directions to four seas. Name them from the map. The flatness of the land makes the rivers flow slowly, and most of them are navigable for long distances by river-steamers. This flatness also makes it easy to dig canals. to join one river to another. Boats and small steamers can go from the Black and Caspian Seas to the Baltic. But there are two disadvantages. First, none of the rivers flows into the open ocean. Russian steamers have a long way to go before they reach the Atlantic or the Mediterranean. Secondly, as Russia is so far from the warm ocean, all its rivers and canals freeze for some months of the year. Even those in the south, flowing into the Black Sea, are blocked with ice for nearly two months. Winter shuts up all the water-gates leading into Russia.

We must remember that, as Russia is so far from the open ocean, its climate is one of extremes. Its summers are hot and its winters very cold and but very little rain falls. The west of

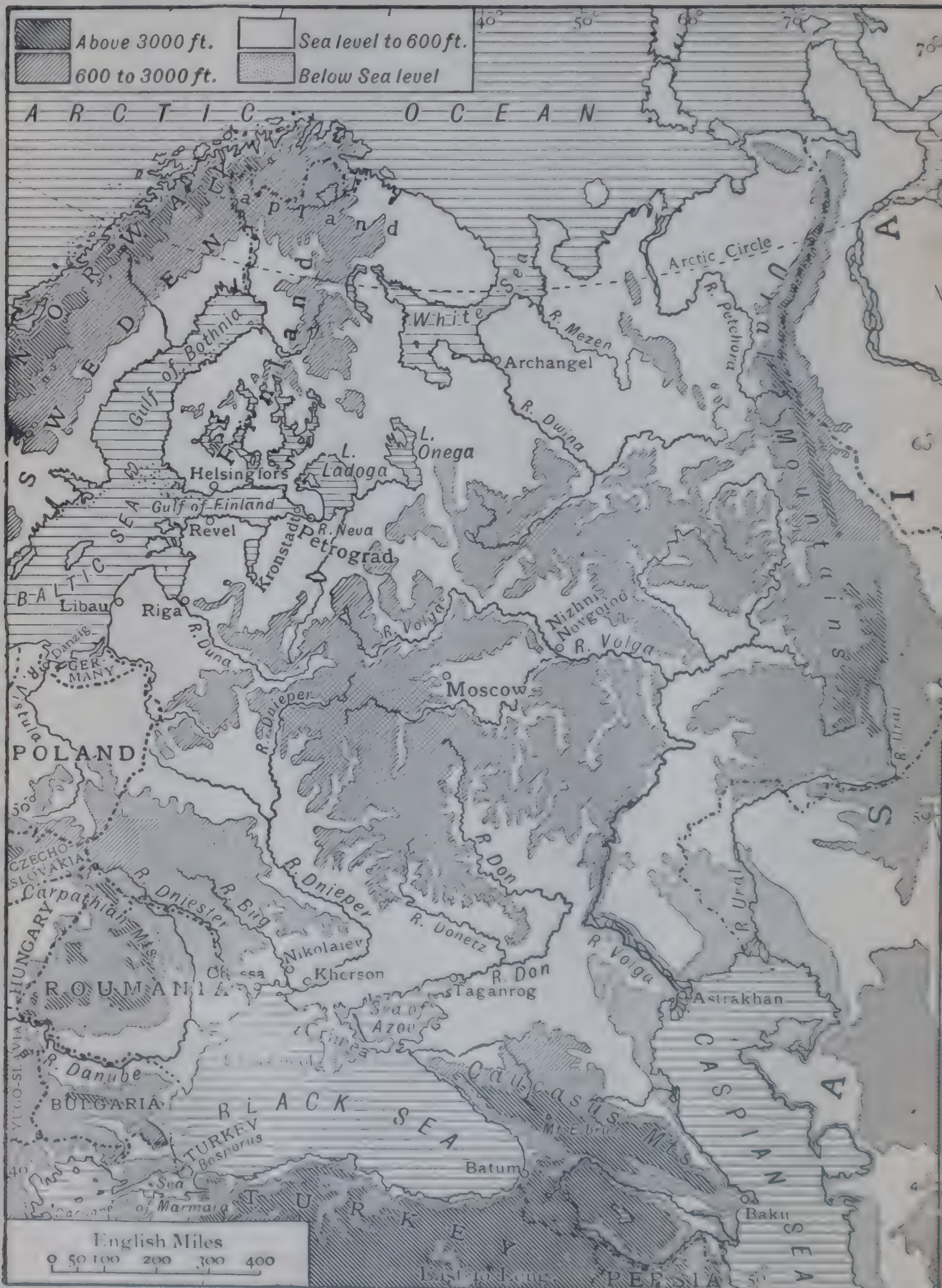


FIG. 130A.—Russia.

Europe is warmed by the rain-winds blowing from the warm Atlantic, but these do not reach Russia. Thus, all over the country, in winter, the land is buried in snow, and the lakes, rivers, and canals are frozen. There are no Himalayas running across the country to keep off the icy winds blowing from the Arctic Ocean. In the summer months, again, the weather is

FIG. 131.—The natural regions of Russia.

very warm in the centre and south, but summer lasts only a few months. We have to do most of our farm work during the monsoon months. In Russia the farmers must sow and reap their crops during the short hot months after the late snows of one winter have melted and before the early frosts of the next begin. The winds blowing from the Atlantic, even if they reach so far inland, are drained of their moisture before they arrive, so that the rainfall is light—less than in

most parts of India. Round the Caspian so little rain falls that the land, as we saw, is poor steppe and desert.

In the north, along the coasts of the White Sea and Arctic Ocean, are Tundra Lands. Here, as in Asia, they are covered with snow for many months in winter and all the rivers are frozen. In the warm season the people live by fishing, hunting and breeding reindeer which feed on the moss. No crops can be grown. South of the Tundra we come to the wide forest-belt, first of cone-bearing trees and then of beeches, which stretches across Russia just as it stretches across Siberia. Here the people live by cutting down timber, gathering forest produce, burning charcoal and, in winter, by hunting for fur-bearing animals. The timber, tar, and turpentine of the forests and the skins of foxes, bears and sables are carried by river, canal and rail to **Archangel** for export. As we pass still southwards, we find the forests have been cut down to make room for fields, and at last we come to the steppes. These are wide, treeless plains of rich black earth very like the black cotton soil of India. These steppes stretch right across Southern Russia from its western borders to beyond the Volga, where they merge into poor steppe and desert. They are being more and more cultivated. The climate suits wheat, which is sent down the rivers and exported from ports on the Black Sea. The chief crop, however, is rye, for rye bread is the daily food of the people. Sugar beet, hemp, maize, millets, barley, oats, and potatoes are also widely grown. Before the war Russia was one of the chief wheat-growing and wheat-exporting countries in the world.

The Volga, the largest river of Europe, rises in the forest belt. On one of its feeders stands **Moscow**, the old capital, in the centre of the plain. Like Paris, Berlin and Madrid, it is the meeting-place of railways. These join it to seaports on the four seas. From it also starts the Trans-Siberian railway, which crosses the Volga and the Ural Mountains and ends at Vladivostok on the Pacific coast. Moscow also spins and weaves cotton. Much of this cotton comes from Central Asia. Coal is brought from mines

Photo. E.N.A.

FIG. 132.- Moscow.

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a little to the south. On the Volga, east of Moscow, is the river port of **Nizhni Novgorod**, where a great fair is held every year. Here Europe exchanges goods with Asia. Before the war tea used to be brought in caravans of camels from distant China. The Russians are great tea-drinkers, but they prefer the China leaf to that of India and Ceylon. Manufactured goods of all kinds came from Germany and Britain. Raw cotton, shipped across the Caspian or carried by the Central Asia railway, came from oases towns such as Tashkent and Samarkand. Costly furs were brought by hunters in the Russian forests. The mines in the Urals sent gold, copper and platinum. Even Persia and India sent goods by caravan, which were shipped across the Caspian and taken by boats for hundreds of miles up the Volga. The river, after leaving the forest region, crosses the fertile black-soil belt covered with fields of wheat and rye. Beyond this it reaches the poor steppe and salt marshes lying north of the Caspian. Here no crops are grown. The people wander about with their flocks from pasture to pasture. They dwell in tents, not in houses, and live on the milk and flesh of their cattle. Here we meet the Kirghiz again. At last the Volga enters the desert country where the people live by fishing in the river. **Astrakan**, on the Volga delta, is the port for trade across the Caspian with Persia and Central Asia.

The south of Russia is drained by several rivers into the Black Sea or the Sea of Azov, which is part of it. The Don, the Dnieper and the Dniester are the largest. Like the Volga, they cross the forest, the wheat and the steppe belts. Boats on these rivers carry down wheat to seaports. **Odessa** is the most important, and exports as much wheat as all the others. It is also Russia's chief harbour for trade with India and the East. During the war England and France could not send troops, guns and munitions to Odessa, to help Russia, because the Turks commanded the straits leading into the Black Sea from the Mediterranean.

On the Baltic coast the surface of Russia is also low-lying. Inland there are large forests, but near the sea, where the

population is denser, much of the forest has been cut down and turned into fields growing rye, sugar-beet, potatoes, flax and hemp. The chief port is **Riga**, which exports wheat, timber, flax and hemp. Russia now touches the Baltic Sea only for a short distance at the head of the Gulf of Finland. Here on a short but broad river stands **Petrograd**, the capital * and the chief trading and manufacturing city in the north. Two hundred years ago Peter the Great, Tsar of Russia, saw it would be a great advantage to have a capital easily reached from the sea. He drained the marshes and built the city which was called after him St. Petersburg. In 1914, as ' burg ' is a German word, the name was changed to Petrograd. The Russians now call it Leningrad. These are only a few of the large towns of Russia. There are twenty more with over a lakh of inhabitants. The Jamshedpur of Russia is **Tula**, the centre of a great coal and iron district which makes iron goods of all kinds. We might call **Kiev**, on the Dnieper, the Russian Benares, for it is a sacred town full of fine churches.

* After the Russian Revolution the city was largely deserted, and Moscow is now the capital of the Soviet Republics.

CHAPTER LIV.

SCANDINAVIA AND IBERIA.

Scandinavia: Norway and Sweden.—Across the Baltic Sea from Russia is the long Scandinavian peninsula. The western part with the Atlantic seaboard is Norway, the larger eastern part, sloping down to the Baltic, is Sweden. Norway is a land of mountains and broken coasts. There is scarcely any low land in it. There are mountains in Sweden also, but all the side bordering the Baltic Sea is low and nearly flat. In Norway there are only a few short rivers flowing down steep valleys to the Atlantic. In Sweden the rivers are longer and, as they flow through wider and less steep valleys, they are more useful. As Norway is full of steep rocky mountains, there is very little room for crops to grow and nearly all the country is waste land. The rest is made up of forests and pastures. In such a mountainous country we do not expect to find a large population. There are more people in a single district in Bengal or Bombay than in the whole of Norway. It is difficult to build railways among the mountains. But the west coast of Norway is very broken and fringed with many islands: it is therefore suitable for harbours. These openings, called fiords, in the coast, though so far north, do not freeze, for they are kept free of ice by the warm water of the Atlantic that is driven into them by the warm south-west winds. The fiords are fringed by high cliffs. A few crops are grown round the farms at the foot of these cliffs and in the valleys, and some sheep and cattle are reared, but the climate and soil are not suited to agriculture. It is quite a different kind of country from Bengal or Bombay. The Norwegians look not

FIG. 133.—A fiord on the coast of Norway.

to the land but to the sea for their living. They build boats and ships out of the timber of their forests. The sea round Norway is full of fish, and the fisheries are the most important industry. The hardy fishers spend the dark days of winter, when the sun for weeks scarcely rises above the horizon, in fishing round the islands off the coasts. The fish are dried on the rocks and brought back to Norway and then sent all over Europe. The oil from the whales they catch is used for lamps during the long nights of winter. The capital of Norway is **Christiania**,* at the end of a long fiord. This fiord does not open into the Atlantic; so it freezes for months in the winter. The harbours on the Atlantic side never freeze. Stavanger and Bergen are two of them.

Sweden takes up the larger half of the peninsula which slopes down to the low shores of the Baltic Sea. This slope faces away from the Atlantic and is separated from it by the high mountains of the peninsula. The climate of Sweden is therefore different from that of Norway. In the first place, it is much drier because the rain-winds from the Atlantic are stopped by the mountains. It is also colder in winter and hotter in summer. Thus the coastal waters of the Baltic are frozen for some weeks in winter. Sweden has, however, much less waste land than Norway and more forests and cultivated fields. Nearly one half of Sweden is covered with forests. Timber is as valuable to Sweden as fish are to Norway. The rivers flowing down the slope to the Baltic are the water-roads on which the logs are floated to the plains. The tree-felling is done in the winter when the trunks can easily slip along the hard frozen snow down the steep slopes to the rivers. When the snow melts, the rivers are full of water. Then the logs are floated down to the saw-mills in the plains. There are thousands of saw-mills in Sweden, most of which are driven by water-power. The poor timber is ground into pulp from which paper is made. Sweden is the chief supplier of timber and wood-pulp in Europe. Charcoal-burning and match making are two other forest industries. Most people in India

* Now called Oslo.

have seen matches and match-boxes which have been made in Sweden out of soft pine wood. The charcoal is used to smelt the iron found in northern Sweden. Swedish iron is of the finest quality and much of the raw ore is sent to England.

Below the forests are the lowlands. South Sweden, the warmest part of the country, grows oats, barley, rye and potatoes. **Stockholm**, the capital, is built on some islands near the entrance of a lake, and is joined by river, canal or rail with all the principal towns. **Goteborg** is the chief port, and trades with British and Baltic harbours.

Iberia : Spain and Portugal.—Iberia, like Scandinavia, is washed on one side by an ocean and on the other by a large inland sea. The climate and crops of these two peninsulas, however, are very different. The large square peninsula of Iberia is cut off from the rest of Europe by the long range of the Pyrenees, nearly two miles high. Snow and ice lie on their highest peaks, and their slopes are covered with forests. Iberia is a great table-land with ranges of mountains running across it. Between these ranges are high, bleak, almost treeless plains, and along these plains rivers flow to the sea. All, except the Ebro, run into the Atlantic. They flow swiftly in deep valleys over waterfalls and rocks between the mountains. As they dry up in the hot months, they are mostly shallow and of little use for boats, but they are very useful for watering the low lands as they get nearer the sea.

Iberia contains two countries, Spain and Portugal. Spain is, like Italy and Greece, very dry. We are back to the Mediterranean once more. Very little rain falls in the table-land in summer when the crops are growing. The mountains facing the Bay of Biscay and the Atlantic catch the rain clouds before they can reach the centre of the table-land. The interior, both in the plains and hills is, therefore, bare and almost barren. Here the summers are hot and the winters cold. It is very difficult to irrigate the land from the deep river-valleys, but, wherever a level spot near a river can be found, wheat is grown. The rest of the table-land is taken up by rough, dry pasture-land on which sheep and goats are

FIG. 134.—A valley in the Pyrenees.

grazed. We can compare the table-land of Iberia with the Deccan of India. Of course the Deccan, being much nearer the equator, is much hotter than any part of Iberia. In such a dry table-land we cannot expect to find many towns. **Madrid**, the capital, stands on a high part of it near the centre of the peninsula. As it is so far from the sea, its winters are very cold and its summers very hot. Railways run out of it to all the chief seaports. Name these from the map.

FIG. 135.—The tableland and valleys of the Iberian Peninsula.

When the rivers leave the high table-land and reach the plains along the Atlantic coast they can be used for irrigation. Here, too, more rain falls. The slopes of the mountains are here covered with forests, and in the plains are meadows, fields and fruit gardens. Here maize, oranges, figs, olives and grapes are grown. There is a great trade in fruit and wine.

Spain is very rich in minerals. There are mines of fine iron near the northern coast and the ore is exported from **Bilbao** and **Santander** to be smelted at Swansea in England.

In fact, Bilbao exports more iron ore than any port in Europe. The Rio Tinto copper mines in the Sierra Morena range are said to be the largest in the world. Spain also produces more quicksilver than any country in Europe. On the southern coasts salt is made and some of it is shipped to Calcutta. Spain is also known to have rich coal-fields, but at present there are but few mines.

The map shows several sea-ports. **Seville**, a river-port on the Guadalquivir, can be reached by ocean steamers which take away oranges, grapes and other Mediterranean fruits. **Cadiz**, the chief Atlantic port, shares in this trade. Of the Mediterranean ports **Barcelona** is the largest. Like all Spanish ports, it exports fruit. It is, besides, the chief manufacturing town, spinning and weaving cotton.

Gibraltar, which belongs to the Empire, is, owing to its position on the narrow strait, very important, for it commands the entrance to the Mediterranean Sea. It is both a fortress and a harbour where ships can coal and it has docks where warships can be repaired.

Portugal takes up most of the western part of the Iberian table-land. The map shows it has a good deal of low land, across which rivers flow before reaching the Atlantic. Owing to the nearness of the sea, its winters are not so cold as those of the inland table-land of Spain nor are its summers so hot. Everywhere we see fruit-gardens, vineyards and fields of wheat and maize. Portugal is famous for wine. It is exported from **Oporto**, at the mouth of the Douro, and from **Lisbon**, the capital on the Tagus. As it faces the Atlantic winds, Portugal receives much more rain than Spain, and its hills are, therefore, covered with forests. One of the trees is the cork (quite different from the cork tree of India), from the bark of which stoppers for bottles are made. Portugal is the chief supplier of cork to the world. Its sawdust is used for packing the grapes exported.

The Mediterranean Lands.—The southern parts of the Iberian table-land, away from the wetter parts facing the Atlantic winds, are very like Italy, the Balkan peninsula,

the northern coasts of Africa, Asia Minor and Syria. In June and July a visitor might perhaps think the climate very like that of India in the dry season. In our hot season the monsoon rains sweep over India. But in these lands the summer months are almost rainless. They are quite unlike the damper parts of Europe. The rain falls mostly in winter when the plants are not growing. In the hot dry months, crops can only be grown in fields and gardens by the help of irrigation. The pasture-lands are therefore poor. Here there are no large herds of cattle. Olive-oil is used instead of butter or ghi. The people breed flocks of sheep and goats which can live on dry pasture. Mules and donkeys take the place of horses. But the dry summers ripen many kinds of fruit such as oranges, lemons, figs and grapes. These are shipped to the northern and colder countries where they cannot be grown. Wine, made from grapes, is the common drink. We might say these Mediterranean lands are a dwelling-place of man half-way between India and Northern Europe. They are, of course, cooler than the one but warmer than the other. They are dry, like India in the cold season, but they have no monsoons to refresh their fields and cover them with crops.


ASIA
RUSSIA
Caspian Sea
AZERBAIJAN
GEORGIA
ARMENIA
Black Sea
TURKEY
TURKEY IN ASIA
UKRAINE
FINLAND
ESTHONIA
LATVIA
LITHUANIA
POLAND
Danzig
Baltic Sea
SWEDEN
NORWAY
DENMARK
GERMANY
HOLLAND
BELGIUM
FRANCE
SWITZ.
AUSTRIA
CZECHO-SLOVAKIA
HUNGARY
ROUMANIA
YUGO-SLAVIA
BULGARIA
ALBANIA
GREECE
Crete
ITALY
Sicily
Corsica
Sardinia
SPAIN
PORTUGAL
AFRICA
MEDITERRANEAN SEA
ARCTIC OCEAN
ATLANTIC OCEAN
BRITISH ISLES
Iceland (to Denmark)
English Miles
0
200
400
600
800
Emery Walker Ltd. sc.

CHAPTER LV.

THE BRITISH ISLES.*

(See Fig. 138.)

Map Study : Size.—On looking at a map of the world we are surprised to find how small the British Isles are. Their area is less than that of Rajputana. From north to south, the larger island measures less than 600 miles, or about the distance from the Tungabhadra to Cape Comorin. The Indus is long enough to go round it. We wonder how such a small country can have become the centre of a wide Empire. England and Scotland make up the larger island ; Ireland is the smaller one to the west. Besides these two main islands, there are many small ones, some scattered and some in groups.

Outline.—The coast-line is very different from that of India. There are many millions of people in India who have never seen the sea. But the coasts of the British Isles are so broken up by estuaries, bays and firths, some long, some short, that it is difficult to place the finger on a spot on the map that is more than sixty miles from salt water. Few people there but have seen the sea or sailed over some part of it. In these openings of the coast vessels can find shelter from storms, and here harbours have been built where ships and steamers can load and unload their cargoes in safety. These steamers can also sail up the estuaries of some of the rivers. This is very different from India, where there are only one or two harbours in which large vessels can shelter.

The Surrounding Seas.—A good map shows the British Isles are really the higher parts of a sunken shelf or platform

* For a more detailed account, see the author's *A New Geography of the British Isles for Indian Students.* T. Nelson & Sons.

which forms the north-western corner of Europe. The sunken part of this shelf is covered by the North Sea, and is nowhere more than 600 feet below its level. Most parts of this sea, of the Irish Sea and the English Channel are much shallower than this. If the surrounding waters sank 300 feet, the British Isles would be joined to Europe by a plain. Thus, like India, these islands have shallow waters along their coasts. Shallow seas, especially if they are moved by currents, are the breeding-places of fish. The North Sea is, therefore, a splendid fishing-ground, and fish form a large part of the food of the people.

Between Britain and the Continent the seas are narrow. A swift steamer sailing across the North Sea can reach the coast of Norway, Denmark or Holland in less than twenty-four hours. The English Channel can be crossed in two or three hours, and the distance between Dover and Calais is only twenty-one miles—no farther than from Pamban Island to Ceylon. Thus, in times of peace, the narrow seas give an easy highway for trade to and from the mainland. In time of war they are a protection. An army can only reach these islands in ships, and the people have for hundreds of years trusted to this protection and to their navy to ward off invasion. The sea separates countries and protects them, but it also joins them. Mountains separate and partly protect countries, but they cannot join them. The mountains in the north and north-west of India defend her from enemies, but they also prevent merchants passing easily across them. Very little trade passes across these mountains from India or into it.

On a large map trace the estuaries of the Thames, the Humber, the Tees and the Tyne, and the Firths of Forth, Tay and Moray—all on the east coast. On the south coast the openings are smaller, but we notice the important sounds that lead to the calm water behind the Isle of Wight. On the west coast the most important estuaries are those of the Severn (Bristol Channel), the Mersey and the Firth of Clyde. All these openings are the highways of trading vessels and they have large and busy seaports on their coasts. The west and north coasts of Scotland are much broken by islands and

arms of the sea, but they are little used by large steamers, because the country behind them is mountainous with only a few people and small villages. In Ireland, also, there are many openings on the coast, but they have few harbours, because Ireland has but little sea trade. On the north-east a wide opening or ' lough ' leads up to the busy seaport of Belfast. On the south coast there is the fine sea gate leading into Cork harbour. On the Atlantic side the long arms of the sea have no important harbours.

One thing, which the map does not show, we should keep in mind—the **tides**. In India the tide does not help vessels except on the Hughli and the Irrawaddy. At other places along our coasts there is but little tide. But in the British Isles a great wave of water, moving over the shallow ocean floor, becomes very deep when it is forced into the bays and estuaries. Twice a day the water rises for several feet along the coasts and in all harbours. This is a great help to ships and steamers. Without it they could not go up some of the estuaries and reach the harbours on them. Besides, the tide as it rushes back, scours out the estuaries and keeps them deep and clear of silt. The tide flows for sixty miles up the Thames and sometimes rises to a depth of twenty-one feet, so that even the largest vessels can reach the port of London.

Position.—The British Isles stretch between 50 degrees north and 60 degrees north, so that they are entirely within the Temperate zone. By turning the globe round so that these islands are in the centre of the side facing us, we see that they lie near the middle of the land hemisphere, *i.e.* the half of the globe which contains all the land except Australia and the farthest parts of South America. They are, therefore, well placed for sea-trade with other coasts all over the world. We might call them the front door of Europe, opening on the Atlantic, which is the world's greatest ocean highway of trade.

Build.—SCOTLAND is the most mountainous part, but even the highest peaks are lower than the Western Ghats. Its northern half is full of high land, and across this, from south-west to north-east, runs a long narrow valley, containing

lakes, which the Scots call Glen More, or Big Valley. The part to the north of this valley is the Northern Highlands; the part to the south of it the Grampian Highlands. These mountainous parts were at one time covered with great glaciers which hollowed out the valleys, wore away the sedimentary rocks and left only the hard primary rocks, so that no coal is found here, and the soil is not deep. The hills are covered with rough grass on which sheep and cattle are grazed. Only in the valleys and beside the many beautiful lakes, hollowed out by ice long ages ago, do we find a few fields and villages. The most southerly part of Scotland is taken up by uplands—not of mountains but of hills—and here the valleys are wider. Here, again, we find many flocks of sheep, and in the valleys of the Tweed and its feeders are towns where tweed cloth is woven.

Between the mountains of the north and these uplands of the south lies a broad valley stretching from the estuary of the Clyde in the west to the estuaries of the Forth and Tay in the east. This is much the most important part of Scotland. Not only is the soil deep and fertile, but here the glaciers did not denude the sedimentary rocks, so that there are rich coal-fields in this valley. Here, therefore, we find a dense population, most of the large towns and almost all the manufactures. Glasgow, at the head of the Clyde estuary, the chief seaport and largest city in Scotland, is the sea-outlet of this valley to the west. In the east there are several important ports, of which Leith and Dundee are the largest. **Edinburgh,** the capital, is joined to Leith. It is a fine city, built, like many Indian towns, round a rock fort. Its chief industry may be said to be education, for it has many schools, colleges, hospitals and museums, as well as publishing houses and printing works. To reach Edinburgh from Dundee the railway passes over two famous bridges—one across the Firth of Tay and the other across the Firth of Forth.

England is much flatter than Scotland. Most of it is a plain, with low hills separated by wide valleys, along which rivers flow in different directions. One range of hills, called the

Photo. Valentine and Son. Ltd.

FIG. 137.—The chief street in Edinburgh (Walter Scott monument in centre).

Pennine Chain, starting from the southern uplands of Scotland, runs southwards halfway down England. These hills are not high, and canals have been dug across them, but they are important, for on their slopes, or near them, are found most of the coal and iron mined in that country. Draw a line joining the mouth of the Humber with the Bristol Channel. The part south of this line is mostly corn land and grass land, and the soil is largely chalk, lime and clay. Here also are low ranges of hills on which sheep are bred. English schoolboys have to learn their names and draw them. It is enough for us if we read their names on the map.

WALES is the hilly country west of the Severn River, with two peninsulas stretching out into the St. George's Channel. These hills are pasture-grounds for large flocks of sheep, and there are only a few fields and villages in their narrow valleys. It is different in the southern part of Wales, bordering the Bristol Channel. Here the land is low and there are mines of the finest coal, a dense population and two or three important seaports.

IRELAND.—Ireland is like Scotland in build, and in other ways like England. Its coast-line, like that of Scotland, especially on the Atlantic side, is much broken, and here we see several small islands, deep bays and the long estuary of the Shannon River. As in Scotland, too, the mountains in some places come down to the sea and form rocky coasts. There are also many beautiful lakes. But unlike those of Scotland, the uplands are very scattered, so that it is easy to make roads and railways. Like England, Ireland has wide plains across which the rivers wander. This flatness has allowed canals to be dug to join them. These plains are largely made up of level beds of limestone. For long ages they were covered with glaciers which rubbed away the primary rocks on the surface so that now there are only a few small deposits of coal. The ice hollowed out the limestone and, as it melted, left bunds of mud and gravel. Thus the Central Plain of Ireland is full of shallow lakes. Large parts of it are covered with bogs in which great masses of peat have formed. This peat is cut out and dried for fuel, for both coal and firewood

are scarce. Ireland is thus a land of meadows, marshes, lakes and mountains. Most of the people live by pasturing cattle and tilling the soil and there are only a few manufacturing towns.

Rivers.—After studying the large rivers of India, we think those of Britain small. The best way to learn them is to trace them on the map and to remember the seaports on, or near, their mouths. In Britain the sun is not nearly so high in the sky and, therefore, not so hot as in India, and rain falls in every month of the year. Thus, the rivers do not dry up as Indian rivers do. In India and Burma, when we think of a river, we think of its use for irrigation. But in the British Isles it is different. There the farmers try to drain the water off their fields into the rivers. No irrigation canals are needed, as plenty of rain falls. We can see how small the rivers are by adding up the length of the Thames, the largest river in England (154 miles), the Tay, the longest in Scotland (94 miles), the Shannon, the largest in Ireland (225 miles). The total comes to less than 500 miles, which is less than the length even of the Narbada or Tapti. The really important part of the large rivers of Britain is their estuaries, where the tide flows up and gives a passage deep enough for large vessels.

Climate.—Even the most southerly part of England is fifty degrees north of the equator, or more than fifteen degrees farther from it than the most northerly part of Kashmir. This shows how much more slantingly the sun shines in the British Isles. Large parts of India, far from the sea, have an extreme climate ; the climate of the British Isles is equable. The summer is only warm, not hot ; the winter is cold, but the frost is seldom severe, and snow covers the low-lying parts for only a few days at a time. The weather changes from day to day, much more than it does with us. It may rain any day ; sometimes it rains every day, and the winds may blow from any direction. The Indian farmer hopes his fields may have good rain in the monsoon ; he knows they are sure to get plenty of heat. The English farmer knows his fields are nearly certain to get enough rain ; he does not fear drought and

famine; what he hopes for is a bright sun and cloudless skies to ripen his crops. In India a poor harvest means there has been too little rain; in Britain it means there has been too little heat and sunshine. As the sea is all round, any wind may bring clouds and rain. But the most usual winds are the westerlies and south-westerlies, blowing across the Atlantic and bringing both heat and moisture. The western half of these islands, facing these winds, receives much more rain than the eastern. We should remember that these Atlantic winds keep the British Isles much warmer in winter than other places in Europe or in Asia, in the same latitude, which are out of their reach and which are not near the open ocean. In Sweden, Germany and Russia snow covers the ground for months in winter, and the canals, lakes, rivers and many of the harbours are frozen. This never happens in the British Isles. An Indian visiting the British Isles wonders at the climate. In his own country he knows what kind of weather to expect at any time of the year. In Britain he does not. The winter is, of course, colder than the summer, but in winter he finds that many days may be warm and rainless or snowless. In the summer, on the other hand, he may not see the sun except occasionally for a whole week at a time, when the rain pours down or the sky is full of mist and clouds. Great Britain has not, like India, a monsoon climate, but a cyclonic climate. This means a climate in which there are frequent changes from high to low atmospheric pressure. Depressions, called cyclones, constantly pass over these islands, coming usually from the Atlantic. In the middle of the area of depression the barometer is low and it is higher towards the edges. Then the wind moves in a spiral direction with an upward movement in the middle. As such a depression passes over the country, rain falls and winds blow, now strongly, now gently, and in different directions. Soon the depression may pass away and there may come an anticyclone, when the barometer is higher in the centre than on the edges. When this happens, the winds are light, the sky is clear and the air warm. No one knows when a depression or an anticyclone may come nor

how long it may last. The only way to judge what kind of weather is coming is to watch the barometer. The Indian visitor finds people studying it every day ; he sees barometers in most of the houses and in public places.

It is believed that this constant changing of the weather gives energy of mind and body to the inhabitants. They are neither oppressed for long with intense cold, nor are they weakened and made listless with tropical heat. The variableness of the climate gives variety to their lives and they escape monotony, than which nothing is more deadening.

Vegetation.—At one time the British Isles, owing to their damp climate, were covered with forests of pine, oak and beech, but these have been largely cut down. Only about five per cent. of the land now grows trees, and these have been planted in recent years. Almost all the timber needed is imported. In India and Burma, with their tropical climates, plants suited for the food of man can be grown on land even 6000 or 7000 feet above sea-level. But in the British Isles all land more than 500 or 600 feet above that level is useless for growing corn or vegetables. Thus, from the physical map we can see at once how much of the surface cannot be ploughed for fields or dug for gardens. Hence, large parts of Scotland, Wales and Ireland, and a good deal of England is pasture land and a good deal of the mountainous parts is only poor grazing ground. If India were in the latitude of Britain, the whole of the Deccan could only grow rough grass and heather, and would, therefore, be very thinly inhabited.

Again, in India people as a rule eat only vegetable food, and, owing to the dense population, there is very little land to spare for growing special fodder crops for cattle. But in Britain cattle, sheep and pigs form a large part of the people's food, and therefore more land is sown with oats, beans, potatoes, turnips and grass, on which these animals are fed, than is used for growing corn for the food of man.

There is another great difference between India and Great Britain. We grow all our own food in our fields. But there only a small part of the food needed by the dense population

is grown in the country. India is an agricultural country, where the people till the soil round their villages. Large parts of England and Scotland are full of busy towns where the people live by manufacturing goods. The other parts of the Empire and foreign countries send all kinds of food—grain, vegetables, eggs, meat and fruit. Without it the people could not live. That is why the Germans tried to sink every ship bringing food to Britain during the war, for without this food she would have been forced by starvation to yield to her enemies. Britain is thus a great market for food-stuffs. Burma sends rice, Northern India sends wheat, tea comes from Assam and Ceylon, wheat and cattle from Canada and the United States. Sugar is shipped from the West Indies and Java, fruit from countries with a Mediterranean climate, wine from France, eggs, butter and cheese from Holland and Denmark. The meals even of a poor man in Great Britain consist of food which has been brought from many countries far and near.

But we must not think that in Great Britain agriculture is neglected. Every acre that can grow a crop is most carefully cultivated. To a visitor travelling through it in the summer it looks like a garden. Almost every house has its own garden in which flowers, vegetables and fruit-trees are seen. The plant that grows everywhere is grass, for the damp climate suits it. It likes plenty of rain, frost does not kill it, as it kills cotton or rice, and it can thrive well without great heat. An Indian wonders to see the greenness. Every field which is not growing crops is covered with grass. More than half the surface is grassland. Grass, indeed, is one of the chief food crops. This is not a joke but true, for it feeds large herds of cattle and flocks of sheep, and beef, mutton, butter, milk and cheese are eaten by every one. Great care is taken to sow the best kinds. A few square yards of these grasses will give as much fodder as a bullock in India can find by a day's wandering over the bare pasture. The crops are grown from the best seed, and these are constantly being improved. The sheep, cattle and horses are the best in the world, for they are the best

bred and the best fed. The cows give four or five times the milk that ours do, and the sheep much more wool than ours. Cattle are not used to carry or plough: that work is done by horses.

Wheat, barley and **oats** are the corn crops. The climate is too cold for rice to grow at all, and maize cannot ripen even in the warmest parts of England. England, with its warmer and drier climate, grows most of the wheat, and bread is eaten at every meal. Oats are used partly as food and partly as fodder. The barley is brewed into beer. But only one-fifth of the country grows any corn at all. It is very largely imported. Potatoes are grown on every farm and eaten once a day at least by all. Turnips, a round root as large as a coco-nut, are cultivated to feed cattle in the winter season. Round all the large towns are market gardens planted with all kinds of vegetables. The people grow food in gardens more than we do in India. Besides vegetables they cultivate many kinds of small fruits. These are boiled with sugar to make jam, which is eaten as a relish to bread, especially in the winter when only imported fruit can be had.

CHAPTER LVI.

BRITISH ISLES—Continued.

Manufactures.—Now, since the people buy so much food from other countries, they must send back other things to pay for them. They send back all kinds of manufactured goods. England and Scotland are manufacturing countries. In India about seven people out of ten live by the land, tilling the ground and growing crops or pasturing cattle round their villages. In Great Britain seven people out of ten live in towns and cities. Why is this? One little word tells us the answer—coal. When we look at a map of India to find out what kind of a dwelling place man has made of it, the first question we ask is, Where are the most fertile lands and where can irrigation be best carried on? In looking at a map of the British Isles, the first question we ask is, Where are the chief coal-fields? In India the most important maps are Rainfall Maps and Crop Maps: in Great Britain the most important is a Geological Map, showing the minerals lying under the surface. The coal-mines of Great Britain have changed it from an agricultural to an industrial country. Coal makes steam, and steam is the power man uses to drive machines. Wherever we travel, we see factories where steam-engines are at work. Large parts of the country are just one vast workshop, where town touches town. Coal is also used to smelt iron and other metals out of which these machines and engines are made. It is cheaper to bring cotton, wool, iron, copper, wood, leather and clay to the coal to be manufactured than it is to take the coal to them. Hence, on and round the coal-fields of England and Scotland all sorts of factories and many

towns have been built where many kinds of raw materials, both those grown in the country and those produced abroad, are worked up into finished goods ready for use.

A map of the coal-fields of Britain shows this. Thus, inland from the mouth of the Mersey there is a large coal-field—the Lancashire coal-field—on which there are many large and busy manufacturing towns. This is the centre of the cotton industry—the spinning of yarn and thread and the weaving of cloth. There is plenty of coal near at hand to feed the engines, and the climate is moist, so that the cotton threads do not snap easily as they do in a dry atmosphere. **Manchester** is the largest town on this coal-field, but a good map shows many others. These towns spin cotton, weave it into cloth of many kinds, dye it, make machinery for the cotton mills, and dig up the coal used in these mills. For miles round, in every direction, we see factories of all kinds. Some of this machinery is sent abroad to other countries where there are cotton mills. Almost every civilized person wears cotton cloth. We can therefore understand how many people all over the world buy it. This city and the many towns round it, are the busiest manufacturing centre in the world.

Still farther inland from Manchester, on the eastern side of the Pennine Hills, there is another coal-field, and here we find more large and busy towns. **Leeds** and **Bradford** are the largest. They spin and weave, not cotton, but wool. Long ago the wool was got from the sheep grazed on the hills, and the water of the rivers flowing down their slopes was used to drive the wool-mills and clean the wool. When machinery driven by steam began to be used, the abundance of coal round about helped the industry, which is now spread over many towns. They manufacture all kinds of woollen goods—flannels, blankets, carpets, felt and velvet. **Leicester**, farther south, on another coal-field, also manufactures woollen goods. A great deal of raw wool used in these towns is now brought from Australia.

Coal, besides making steam, is used to smelt iron and from iron steel is made. To make iron easily and cheaply we must

have plenty of coal close to the iron mines. The iron smelting works of Bengal are not far from the Raniganj coal mines. Thus, close to coal and iron mines large towns have grown up, making many kinds of iron goods. On the north-eastern side of England there is another important coal-field over which the Tyne River flows. **Newcastle**, on this river, is the centre of a large coal-mining area. South of Newcastle, at the mouth of the Tees, **Middlesbrough** has large smelting works. The iron is dug out of the hills behind it and it can get coal easily from Newcastle. To its harbour iron ore can easily be brought from Sweden and from it the smelted iron can easily be exported. In South Wales there is another large coal-field, with many mines, which has given birth to great industries. The Welsh seaports of **Newport, Cardiff** and **Swansea** receive large ship-loads of iron, copper, zinc and tin, to be smelted in the towns lying behind them. A special industry here is the manufacture of tin plate used in making boxes of all kinds and of corrugated iron coated with zinc. These are exported to India and all parts of the world. Large quantities of steel goods, *e.g.* steel tubes, and copper goods are also manufactured. Cardiff is now the chief coal-exporting seaport in the British Isles, and the coal is of the finest quality, being nearly smokeless.

Birmingham, a large inland city, lies about midway between Cardiff and Manchester, on another coal-field. It is the centre of the 'Black Country,' so called on account of the smoke from factories and manufacturing towns round about which darkens the air. Its workshops echo with the noise of anvils and hammers making all kinds of iron, steel, copper and brass ware. Screws, nails, pots, chains, guns, pipes, needles, pins, steam-engines and machines—these are only a few of the things made. For the manufacture of earthenware we need plenty of clay to shape the vessels and of fuel to bake them. Just north of the 'Black Country' is a district called 'the Potteries,' with plenty of clay and coal. This district has made England one of the largest manufacturers of earthenware and porcelain in the world. Six large towns are engaged in this work. They really form one large town—**Stoke. Shef-**

field, near the centre of England, has plenty of coal and iron near at hand. Its special business is the making of steel cutlery, *i.e.* all kinds of knives, tools and instruments. It also turns out steel rails, tyres and axles, guns and armour-plate for war vessels. For the finest work it uses iron ore imported from Sweden. These are only a few of the chief manufacturing districts of England. Almost every town marked on the map is a centre of manufactures—of cotton, silk, or wool, of iron, steel, copper, glass, of leather, wood, chemicals, dyes, paper, rubber, etc.

Another very busy manufacturing district is the central valley of Scotland where there are coal-fields and iron mines. **Glasgow**, at the head of the Clyde estuary, is the largest town, next to London. Its damp climate favours the making of cotton cloth and, with the coal and iron round about, it manufactures all kinds of machines and engines. It is surrounded by a ring of busy iron towns. **Paisley**, not far off, is famous all over the world for its sewing thread. **Dundee** imports jute from Bengal, with which it makes carpets and sailcloth and cloth.

But there is one special business we should study—**Shipbuilding**. Great Britain is an island and the greatest sea-nation in the world, with more steamships than any other. It does most of the carrying trade of the world. Large mail-steamers, merchant vessels and warships are no longer made of wood but of iron and steel. Britain not only makes these for her own use, but sells them to other countries. In every harbour in the world we see ocean-vessels and on almost every deep river and lake we see shallow-draft vessels which, with their engines, were built in British shipyards.

For shipbuilding there must be a good supply of coal and iron near at hand and calm and deep water into which the vessels can be launched. **Glasgow** is the chief centre in the world of shipbuilding, including the making of marine engines. When we sail down the Clyde estuary, our ears are deafened with the sound of hammers riveting the pieces of iron together. It is a long water-street with shipyards on either bank. The

Tyne is another water-street of this kind. So is the Wear. **Newcastle** is the most important centre. **Gateshead** and **Sunderland** are two others. **Belfast**, in the north-east of Ireland, is another shipbuilding town. It gets its coal from Scotland and its iron from England.

Seaports.—In India, Burma, and Ceylon there are only half-a-dozen large seaports—Bombay, Calcutta, Karachi, Madras, Rangoon, and Colombo. But in Britain there are many. Why is this? In the first place, in Britain there are many suitable places for harbours where ships can lie in deep water sheltered from storms. The map shows many harbours on the estuaries of rivers and on long arms of the sea entering the land. Again, on the coasts facing the eastern and southern shores of Britain there are many seaports, and harbours have been built opposite them; some of them trade with Norway and the Baltic ports; others with Hamburg and Bremen in Germany; others with Rotterdam and Antwerp; and others with French and Portuguese ports. In early times, when most of the sea-trade of Britain was carried on across the North Sea and English Channel, the seaports were chiefly on the coasts facing Europe. Later, when trade with India and China increased, and especially after America was discovered, suitable places on the west grew into seaports, such as Bristol, Cardiff, Liverpool, and Glasgow. But, even though an arm of the sea is suitable for a sheltered harbour, a harbour will not be built there unless the country behind it has goods to export, either foodstuffs, raw materials, coal or manufactures. The map shows many sheltered arms of the sea on the north and west coasts of Scotland and Ireland, but they have no large seaports, because the country behind them consists chiefly of mountains, where little is grown, and because there are no coal mines or iron mines near them to be the birthplaces of large manufacturing towns.

On the South Coast.—Here **Plymouth** and **Southampton** are important, because they are the nearest harbours for ships coming up the English Channel. Southampton lies in an opening sheltered by an island. The large passenger steamers

The high and low lands
of the
BRITISH ISLES
English Miles
0
50
100
Principal railways
Coalfields
(Only the chief towns are marked)
Orkney
Islands
C. Wrath
Wick
Moray Firth
Kinnaird Head
Hebrides
Skye I.
Inverness
Glen More
Aberdeen
Grampian Highlands
ATLANTIC
OCEAN
NORTH
SEA
To Baltic ports of Sweden & Denmark
Arbroath
Dundee
Firth of Tay
Perth
Mull I.
Leith
Firth of Forth
To Baltic ports
Islay I.
Greenock
Paisley
Glasgow
Edinburgh
R. Tweed
To Hamburg
North Channel
Malin Hd
Hawick
Uplands
8°
4°
0°
56°


IRELAND
Dublin
Central Plain
Galway B.
R. Shannon
Limerick
Cork
Cork Harbour
C. Clear
Waterford
Wexford
St. George's Channel
I. of Man
IRISH SEA
Anglesea I.
Cardigan Bay
Preston
Manchester
Liverpool
Birkenhead
York
Leeds
Hull
Grimsby
Sheffield
Spurn Hd.
The Wash
Stoke
Nottingham
Leicester
Birmingham
Avon
Cotswold Hills
Chiltern Hills
Yarmouth
Lowestoft
Cambridge
Harwich
52°
London
R. Thames
Dover
Folkestone
Calais
Boulogne
North Downs
South Downs
Newport
Swansea
Cardiff
Bristol
Bristol Channel
Exmoor
Dartmoor
Southampton
Portsmouth
I. of Wight
Brighton
Beachy Head
Plymouth
Start Pt.
Lizard Pt.
Lands End
Scilly Is.
ATLANTIC OCEAN
ENGLISH CHANNEL
FRANCE
To New York
To Indian ports
To Australia via the Cape route
Bombay via Suez
Longitude West 8° of Greenwich
0°
Emery Walker Ltd. sc.

FIG. 138.

Photo. Central Aerophoto Co.

FIG. 139.—Docks at Southampton.

which ply across the Atlantic leave and arrive here. Fast trains take the passengers to and from London. On the coast facing France, Holland, and Belgium there are cross-channel or ferry ports where the railway companies transfer their passengers and goods on packet steamers and land them at corresponding railway ports on the Continent. Through these harbours great quantities of perishable goods, such as meat, eggs, fish, fruit, vegetables and butter, are imported. Of these ports **Dover** is the busiest. Why? Other two are **Folkestone** and **Harwich** (on the east coast).

On the Bristol Channel.—From a good map we can guess that the ports here must trade chiefly with Spain and across the Atlantic with the West Indies, South America and the United States. **Bristol** has a large import trade in tobacco, sugar, cocoa and plantains from the West Indies. Millions of bunches of this fruit are landed here every year. More tobacco is manufactured here than in any other town in Britain. Grain is also brought in large quantities from North America and the Argentine. In fact Bristol is the great market and distributing centre for grain and provisions for the West of England.

The Welsh ports **Cardiff, Swansea** and **Newport** have the rich coal-producing valleys of South Wales behind them. This famous coal is smokeless and is very largely exported. Cardiff is the world's biggest coal port. To the coal furnaces behind them they import ores of iron, silver, lead, tin, copper and zinc to be smelted. Swansea is the busiest metal-smelting place in the world. Three-fourths of the tin-plates produced in Great Britain are made within twelve miles of the docks. Recently Swansea has become a very important place for refining mineral oil. Ships constantly arrive with crude oil and take on board refined oil.

On the Mersey.—**Liverpool,** on the splendid deep estuary of this river, has seven miles of docks. It is the sea-gate of the greatest manufacturing districts in England, with scores of towns and thousands of factories and workshops. It receives the food and raw materials they need and exports the

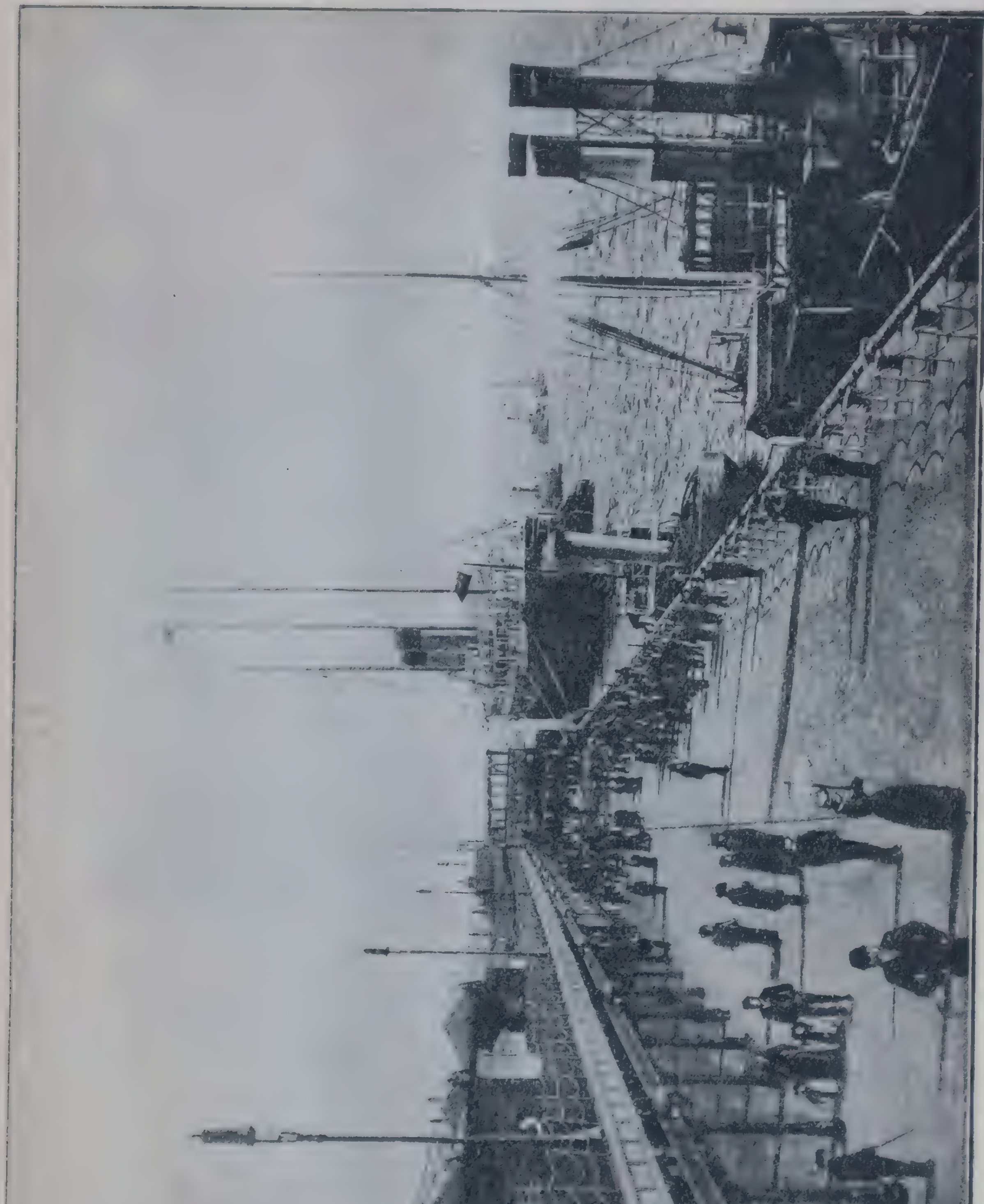

Photo Valen'ine and Sons, Ltd.

FIG. 140.—Landing Stage, Liverpool. (The large Steamer is starting for America.)

goods they make. Ocean steamers bring raw cotton, wool, hides and wood, and they take back yarn, cloth, machinery, earthenware, iron and leather goods of all kinds. Not a thread of cotton can be grown in the cool climate of Britain. It comes to Liverpool from the United States, India, Egypt and Nigeria. **Birkenhead** is a sister town and port on the opposite bank of the Mersey. A deep ship-canal joins Liver-

FIG. 141.—The centre of London—The Bank of England (left) and Royal Exchange.

pool with **Manchester**, and regular lines of steamers carry goods between Manchester and ports in India and other countries.

On the Clyde.—This estuary has several seaports on its banks. At its head the river has been deepened to allow large ships to reach **Glasgow**. This important city and port is the western sea-gate to and from the densely peopled central valley of Scotland dotted over with busy mining and manufacturing towns.

On the Eastern Coast of this central valley there are several seaports. **Leith** on the Forth estuary and **Dundee** on the Tay

Photo. W. S. Campbell.

FIG. 142.—Houses of Parliament.—Full tide on the Thames.

are the most important. Leith is the harbour of Edinburgh and trades across the North Sea with German ports. Along with other harbours on the Forth estuary it exports large quantities of coal from the coal-fields in the central valley. Dundee has a large trade with Calcutta, importing shiploads of raw jute which it spins into coarse cloth and carpets. Further north, **Aberdeen** is a busy fishing port. Hundreds of small steamers bring in loads of fish caught in the North Sea and round the Orkney and Shetland Islands and Iceland, and they are sent by special trains to inland towns, even to London.

On the East Coast of England.—The Tyne, Wear and Tees enter the sea by small estuaries and cross large coal-fields. Here we find several large manufacturing towns and seaports. The Tyne is like a great water street with busy towns on either side. **Newcastle** is much the largest, and sometimes three or four hundred vessels loaded with coal leave the Tyne in a single day. This coal goes chiefly to London and across to the Continent, but large quantities are shipped to the seaports, such as Port Said, Aden and Colombo, to feed the steamers which carry on the sea-trade of the world. **Hull**, on the Humber estuary, is one of the busiest ports in Britain, and trades with Germany, Norway and the Baltic ports. Russia and Germany send flax and tallow, and Norway sends timber. Wool comes from Australia, and is sent inland to be spun and woven at Leeds and other towns round it. Large quantities of oil-seeds from India and other countries are imported, for Hull makes more oil-cake and oil than any other place in Britain. **Grimsby**, on the opposite shore, is the chief fishing-port in the country. It lies close to the best fishing grounds of the North Sea, and thousands of boats bring in fish which are taken by train to London and other large towns. Lowestoft and Yarmouth share in this fishing trade.

Ireland, as it is a grazing and agricultural country with few manufactures, does not carry on much trade with foreign countries, but it sends plenty of cattle, pigs, butter and eggs

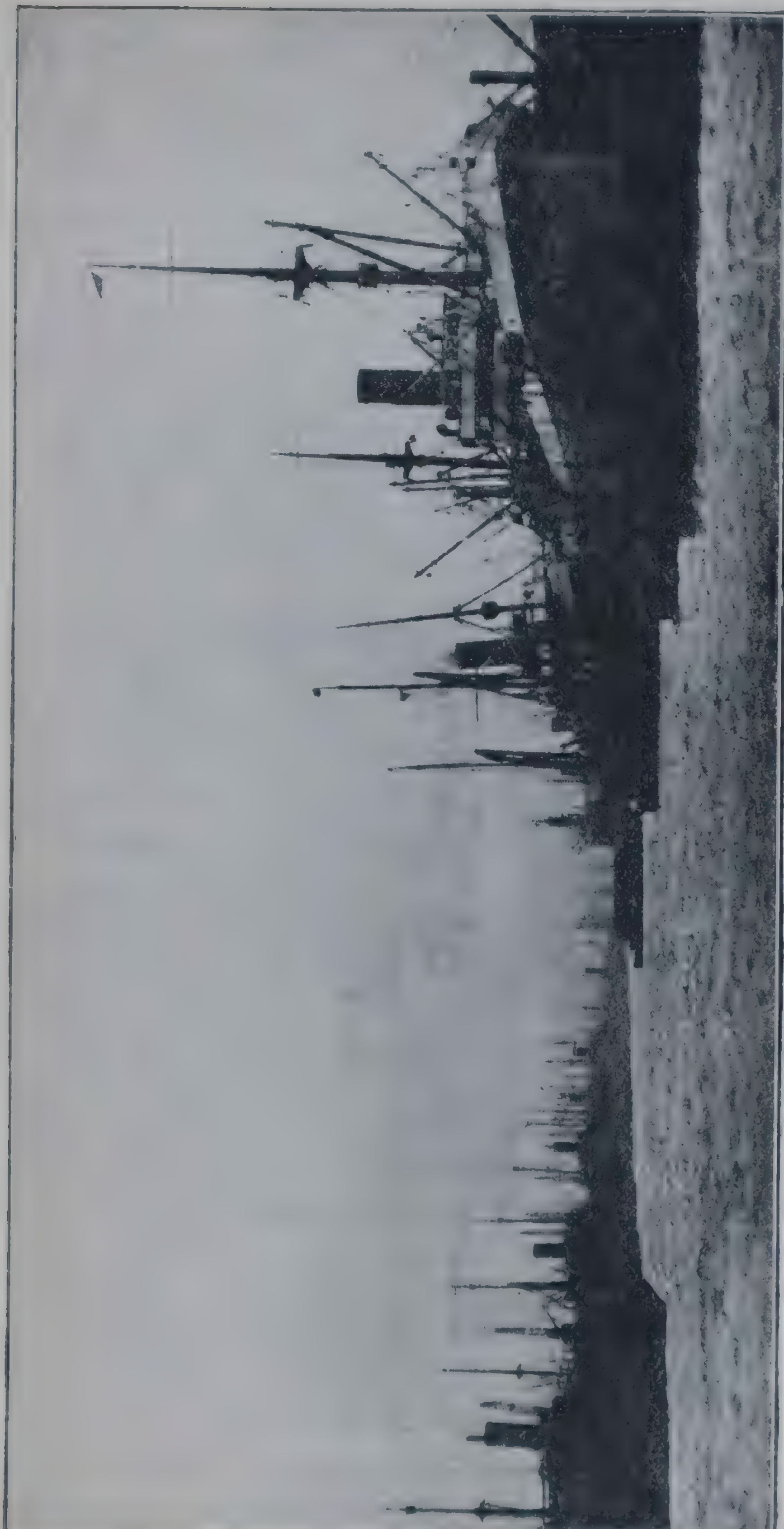

FIG. 143.—Vessels discharging cargoes at the Royal Albert Docks, London.

Photo. Sport and General.

across the Irish Sea to England and Scotland, and imports their manufactures as well as foreign goods. **Belfast** is the chief port and almost the only manufacturing town. Besides building ships, it makes and exports fine linen cloth woven from flax imported from Belgium and (before the War) from Russia. It spins more twine and ropes than any other place in the world. **Dublin**, the capital of Ireland, trades with Liverpool on the opposite coast. On the southern shores **Cork** has a large sheltered harbour. The mail-steamers from America land their letters here. They are then sent by a fast train to Dublin and then by a swift steamer across to England.

The larger part of Ireland—the Irish Free State—has now a Parliament of its own which meets in Dublin. Seven counties in the north form Northern Ireland with a Parliament meeting in Belfast.

London.—We have left the most important town to the last. London is much the largest city in Britain or in the world. It contains about six times as many people as Bombay or Calcutta. It is also the most important seaport of the world's trade and has been so for hundreds of years. It is built on both sides of the Thames at the head of its estuary. This river, helped by the tide, gives a fine deep waterway for the largest vessels up to the docks. There are more people in London than there are in Holland, Denmark or Greece. London is, therefore, a very important market for goods. It is the world's greatest *entrepôt*, *i.e.* the place where goods from all over the world are brought to be sold and transhipped to other countries. Almost all the tea and coffee sent from India goes to London to be sold in this way. It is the same with rubber, spices and Australian wool. London is also the greatest manufacturing city in Britain. It has no special industry, but a large number of small ones. For hundreds of years it has been the capital of England, *i.e.* the city where its chief business is carried on, where its Parliament meets, where its chief law-courts are held and where the great merchants have their offices. It has thousands of public buildings—palaces, banks, colleges, museums, libraries, hospitals. Its

railway stations must number over a hundred. But the main reason why London is now so important is that it is the capital not only of Great Britain but of the Empire, and not only of the Empire but of the business world. Every large firm not only in England, Scotland and Ireland, not only in India, Burma, Ceylon or China, but in almost every part of the world, has an agent in London to do its business there. Every large bank in the world has a London office. London is joined with all parts of England and Scotland by railways. A railway map shows lines running out of it in all directions. These main lines are joined by branch lines to every town and almost every village in the country.

The pupil must remember that only a few of the towns in Great Britain are mentioned in this book. There are hundreds of others. As we travel over the lowlands of England and across the central valley of Scotland, no sooner do we leave one town than we see the smoke of another, with its mills, its factories or its docks.

CHAPTER LVII.

THE TRADE OF GREAT BRITAIN.

Imports.—India and Burma export food and raw materials (such as rice, wheat, tea, coffee, oil-seeds and jute) and import many kinds of manufactured goods. In Britain the opposite is the case. She cannot grow nearly enough food for her own wants, and therefore imports a great deal of what she eats. To pay for it, she sends abroad large quantities of manufactured goods. To make these goods she has not nearly enough raw materials (such as iron, wood, cotton, wool, etc.) and so she has to get them from abroad.

(*a*) **Great Britain has become the great food market of the world.** The people of other countries know that if only they can supply corn, meat, fruit, milk, eggs, tea, coffee and sugar of good quality, cheaply, there are thousands of people in the British Isles ready to buy them.

Wheat and Flour.—Bread, the chief food of the people, is made from the flour of **wheat** and **maize.** Britain cannot get all the wheat she needs from the Empire. Canada sends ship-loads from her wide prairies ; so do the irrigated lands of the Punjab and the wheat farms of Australia and New Zealand. But much of the flour eaten comes from the United States, Roumania and Argentina. The maize is grown on the central plains of the United States. **Barley,** largely used for brewing and distilling, comes from Canada and the United States. **Rice** is not nearly such a common food in Britain as in India. India, China and Japan are the largest growers of rice, but they need it all to feed their own large populations. The rice that goes to England comes chiefly from Burma.

Meat.—It is difficult for us to understand what an enormous quantity of meat is yearly imported into Britain. Live cattle are shipped from the pasture lands of Canada and the United States. Ships laden with the frozen carcases of cattle and sheep are sent from Australia and New Zealand. This beef and mutton are eaten fresh. Canada, the United States and Argentina also send very large quantities of cooked beef and mutton in tins. A great deal of butter and cheese and millions of eggs come from abroad. From Denmark, Holland and France, such perishable goods can, owing to the short journey, be sent in good condition to English markets. Large steamers with freezing chambers can bring fresh butter from Canada and Australia and cheese from Canada and the United States.

Fish.—Steam fishing-boats, called trawlers, catch large quantities of fish in the North Sea and round the coasts; tinned salmon come from Western Canada (Fraser River) and dried cod from Newfoundland.

Fruits and vegetables.—Great Britain, though a fruit-growing country, buys large quantities of fruit. Thousands of barrels of apples are shipped every year from Canada, Tasmania and the United States. Lemons, oranges, grapes, both fresh and dried, figs and almonds are imported from the warmer fruit-ripening countries lying along the shores of the Mediterranean. Dates come from the oases of Arabia and North Africa, and shiploads of plantains from the West Indies. Perhaps India will some day get part of this trade.

Sugar.—India can spare no sugar. Britain must get what she wants from the West Indies, especially Jamaica and Cuba, British Guiana and the Dutch island of Java. Some cane-sugar also comes from Queensland. Before the War the people of the British Isles bought a great deal of **beet sugar** from Germany, Austria, Russia and Belgium. The people of Britain drink **tea** every day, and large quantities have to be imported. Forty or fifty years ago they drank China tea, and a little is still brought from that country. But, at the present day, nearly all the tea drunk in Britain and her

Colonies comes packed in boxes from the tea-gardens of Assam, Darjeeling, the Nilgiris and Western Ghats and the hill-slopes of Ceylon. India sends almost all her **coffee** to British markets, but much more is drunk than she can supply. It is mostly shipped from Brazil and the West Indies. **Cocoa,** used as a beverage and to make chocolate, can only be grown in the hottest parts of the world. It comes chiefly from the Guinea Coast of Africa, Trinidad and other islands of the West Indies, and the countries of Ecuador and Brazil. France, Spain and Portugal are the chief growers of the grape and the largest makers of **wine**. They send it to England from the seaports of Bordeaux and Lisbon. Some wine is also imported from South Africa and South Australia which have a Mediterranean climate. Great Britain grows no **tobacco.** Owing to the import duty, a good cigar in England costs more than eight annas, and therefore only well-to-do people can smoke them. The finest cigars are sent from Havana in the island of Cuba and from Manila in the Philippines. Enormous quantities of cigarettes are imported from the United States and Egypt. Most smokers smoke pipes and they use tobacco prepared in England from leaf imported from the United States. Only a few Indian cheroots are imported.

Raw materials.—Besides being the food-market of the world, Britain is its greatest workshop. But just as Britain grows only a small part of the food she eats, so she produces only a fraction of the raw materials she uses in manufacture. Though she is by far the largest manufacturer of cotton goods in the world, yet no **cotton** can grow in the country: the winter frosts would kill the plants in a night. Every fibre of raw cotton used must be imported, and nearly one-half of the world's crop is sent to Lancashire mills. It is important that the cotton mills of Great Britain should be supplied with cotton grown in the Empire. But this is not yet the case. Some comes from the fertile Nile Valley and the Sudan, some from Nigeria and British East Africa, and some from the Punjab and the cotton soil of the Deccan, but this is not enough to supply the hundreds of cotton-mills in England, and the chief source of

supply is still the United States. The United States grow more cotton than all the rest of the world put together.

Jute.—Raw jute is exported from Calcutta to Dundee and other towns in Scotland, where it is made into canvas and carpets. The **raw silk** used in silk-mills comes from Japan, China, Italy and France. India also sends some raw silk to Britain but more of it is exported to France.

Wool.—The native wool is not nearly enough to supply the great wool factories of Britain. She imports it from the sheep-rearing pasture lands of Australia, the plains of New Zealand and the table-land of South Africa.

Timber.—The forests of Britain have largely disappeared and she has to import the timber she needs. The common deal wood comes from Sweden, yellow pine from Canada, oak from Europe and America, mahogany from British Honduras and teak from Burma and the Malabar coast.

Hides and skins.—These are brought from pastoral countries such as Australia, South Africa, South America and India. India sends shiploads of cattle and buffalo hides and goat skins. **Rubber** is being used more and more owing to the increased number of motor cars and bicycles. The Straits Settlements, India and Ceylon, where the climate is damp and hot, send a great deal of raw rubber from the plantations which have been made there in the last twenty years.

Minerals.—The iron-mines of Britain are not sufficient to supply her needs, and so large quantities of foreign ore are imported. Very little iron ore can be got from countries within the Empire, though there are good mines in Newfoundland. The United States produce more iron than any other country, but it is manufactured at home, not sent abroad. Great Britain, therefore, gets most of her foreign iron ore from Sweden and Spain. **Gold** comes from the Transvaal mines at Johannesburg, from Australia and the Kolar fields in India. Canada and Australia supply some **silver**, but Mexico and the United States are really the chief sources of silver. **Copper,** largely used in electrical machines, comes chiefly from foreign countries, such as the United States, Mexico and Japan, but

Australia supplies some. **Lead** is brought from the United States, Spain, Burma and Australia. India supplies most of the **manganese** imported, and Canada almost all the **nickel.** **Wolfram** is shipped from Burma and **tin** from Singapore, to which it is sent to be smelted from the Malay Peninsula and Burma.

Exports.—To pay for her vast imports of food and raw materials Britain exports other goods to all parts of the world, both within the Empire and outside of it. These goods are manufactured in her mills and workshops. We have already learned the chief exports of this kind to India and Burma. By far the largest item is **manufactured cotton,** *i.e.* yarn, thread and piece-goods of all kinds. Warm countries, such as Egypt, India, Central and West Africa, the East Indies, China, Japan, the West Indies and the countries of South America, are the chief buyers. The cotton mills of Bombay and other towns of India are, however, catching more and more of the trade in cotton goods used in India, Africa and the East Indies. There are also large exports of **woollen goods,** such as cloth, flannel, blankets and thread (called worsted). They are made from wool grown in England or imported from Australia. These goods go chiefly to the colder countries of Europe and Asia, to Canada, Australia and the United States. Britain exports also large quantities of **linen thread and cloth,** as well as some silk. Chemicals, rubber and leather goods are a few of the other exports. Books printed in Britain are sent to all parts of the world where the English language is spoken.

Metal goods form a large part of British export trade. We have seen that many of them come to India. Manufactured iron and steel in a hundred different shapes are sent to all corners of the world, as well as articles made of brass, copper, lead and tin. Then there are all kinds of **steam engines** and **machinery** for mills and factories. Machines, tools and instruments made in Britain are not always the cheapest, but they are known to be the best and last longest. In all parts of the Empire we find people using metal goods of iron, lead, brass, copper and tin made in British workshops. Another

important export is **iron and steel ships.** More than half the steamers in the world have been made in the shipbuilding yards of England, Scotland and Ireland. Many foreign countries buy English steam-ships. As we have seen, certain kinds of provisions are exported to India and Burma. Many also are sent to the Colonies. Beer, whiskey, salted herrings and biscuits are the chief of these.

Coal is the only raw product of Britain which is exported in large quantities. The export trade in coal is enormous. It is sent to those European countries, such as Norway, Sweden, Holland, Denmark, Spain and Italy, which have little or no coal of their own. During the Great War England supplied her Allies with large quantities of coal. The great coaling stations of the ocean-routes, such as Port Said, Aden, Colombo and Singapore, are supplied with British coal. It comes chiefly from Cardiff and Newcastle.

CHAPTER LVIII.

AFRICA.

(See coloured map and Fig. 147.)

Map Study. Position and Outline.—This huge, solid-looking continent lies on both sides of the equator. Its most northerly point is in the latitude of the extreme north of Kashmir; its most southerly point is in the same latitude south of the equator. It has a large round shoulder pushed out to the Atlantic and a short, sharp horn to the Indian Ocean with a long, broad, blunt peninsula pointing south. A steamer sailing due west from Colombo would reach the nearest part of its coast in about four or five days. From Europe it is separated by the broad Mediterranean, and from Asia by the narrow Red Sea in the north-east. In shape it is not unlike a huge map of India, with its large island of Madagascar matching the small island of Ceylon. Its coast line is much less broken than that of Europe or even of Asia. In this respect it resembles South America and Australia. On the west is the broad open Gulf of Guinea; on the north the small Mediterranean Gulf of Tripoli, and on the east the Gulf of Aden, a part of the Indian Ocean. Madagascar is the only large island off the coast. The other islands are small and few in number.

Relief. The Table-land of Africa.—Africa is unlike Eurasia in outline; it is also unlike it in build. In Eurasia the high land stretches right across Asia and Europe. But Africa has few great mountain ranges. All the other continents have wide low lands. Africa has none. Almost the whole of it is higher than the Deccan. A good physical map shows that Africa is really one vast table-land, the edges of which come

quite close to the coast nearly everywhere. The narrow coast lands are really the first steps of terraces which form the edges of this table-land. These edges are, as a rule, higher than the inland parts. As the rivers have to break through this rocky rim before entering the sea, they are of little use as inlets to the interior. Hence, if Africa is to be opened up to foreign trade, this can only be done by making railways to climb up into the table-land from harbours on its coasts. The African table-land is higher in the southern half of the continent than in the northern half. If we draw a line from the middle of the Red Sea to the mouth of the Niger, we can say that all Africa south of this line, except the Congo basin, is a high table-land, not flat, but rising into higher land here and there. The part to the north of this line is a lower table-land.

If we draw another line from the middle of the Red Sea right to the southern end of Africa, we trace the line of a belt of high land. This is not a long range of mountains like our Himalayas. It is just the part of the table-land which has been most raised. In the part of it bordering the Red Sea rises the huge block of Abyssinian Mountains, thrice as high as the Western Ghats, made up of old volcanoes covered with lava. At the other end this band of high land follows the east and south coasts, where it is called the Drakenberg or Dragons' Mountains. Near its middle, round Lake Victoria, this band of high land rises to the highest peaks of Africa—Kenya, Kilimanjaro, and Ruwenzori. Though quite close to the equator, their tops are covered with snow. This great belt of high land seems to have been raised and bent and cracked into rifts and valleys, in which lie large lakes. One gigantic rift or furrow contains the Albert, the Edward, the Tanganyika and the Nyasa Lakes. In another hollow in the table-land to the east is Africa's largest lake—Victoria—with an area greater than that of Ceylon.

The part of Africa lying to the north of our first line is also a table-land, but much lower than that which fills up the whole of the south of Africa. One higher part of it stretches in a south-east to north-west direction and is called the Tibesti

High Land. Another stretches along the north coast of the Gulf of Guinea, and forces the Niger to make a big bend inland. In the north-west corner facing Spain are the Atlas Mountains, thrice the height of the Western Ghats, and covered with snow. They really consist of two parallel ranges with a table-land in the middle. Just near the middle of the northern table-land the surface sinks. Here Lake Chad, lying in a slight hollow, is a centre of inland drainage like the Caspian and Dead Seas.

Climate. Heat and Rainfall.—The position of the continent of Africa tells us something about its climate. No

Arrows show the direction of prevailing winds

FIG. 144.—Rainfall map of Africa.

other continent has such a large part within the Tropics. No part of Europe or of Asia—not even the tip of the Malay Peninsula—touches the equator. But it is quite different in Africa. Its most northerly shores and its southern extremity lie, as we saw, in about the same latitude as the north of Kashmir. The sun at noon never shines at a

great slant on any part of it. No part, therefore, will be very cold, and most of it will be very hot. Snow only falls on the tops of the highest mountains. Secondly, as Africa is a huge table-land, the heat will not be so great as it would be, if it were a low flat plain like the Gangetic valley. But on the low-lying narrow coast-strips near the equator the heat is great, and the climate damp and feverish.

The most important part of the climate of Africa, as of that of India, is the rainfall. The rainfall map should be carefully studied. Westwards from the Red Sea right across the continent scarcely any rain falls except in the high Atlas ranges facing the Atlantic winds. The prevailing wind across this dry belt is the N.E. trade. The heat in this broad belt of the Sahara is great; even the little rain that does fall is soon evaporated by the sun. Not a single river rises in this dry region, for most of it is desert. In the south-west corner of Africa, also, there is a very dry area, for here the south-east trade winds blow from the land. But the whole of the centre of Africa receives plenty of rain, especially the parts inland from the Gulf of Guinea. In India the rain comes in the hot months. The same thing happens in Africa, but, as Africa stretches on both sides of the equator, there are really two hot seasons. In our hot months there is great heat (for the sun is overhead), and much rain falls in those parts of Africa lying just north of the equator. In our cold season the sun is overhead in those parts lying just south of the equator, and then much rain falls there too. Thus, heavy rain falls in a broad belt across the middle of Africa. In our hot season the S.E. trades of the Indian Ocean are, after crossing the equator, turned to the right, and become our S.W. monsoons blowing rain-clouds into the low-pressure area lying over India. In the same way, in Africa during the same season the S.E. trades of the Atlantic are dragged to the right across the Gulf of Guinea by the low-pressure area lying over northern Africa, and become seasonal winds giving heavy rain in a broad belt stretching from Cape Verde to Lake Victoria. Rain is more spread over the southern half of Africa than in the most

northerly part. The reason is that in the former the south-east trade winds blow much rain in from the Indian Ocean. The northern part has the great land mass of Eurasia in the north and east. The whole of the south-west of Asia facing Africa is high, dry table-land. Thus the winds blowing from Asia are dry and can bring no rain.

Sea Currents.—A warm sea-current flows southwards along the eastern coast of South Africa, and a cold sea-current flows northwards along its western shores. Winds blowing over warm water carry off more moisture than winds blowing over cold water. This is another reason why the coast of Natal is warmer and wetter than the desert coast on the Atlantic side.

Rivers.—We may be sure all the large rivers will rise in the belt of heavy rainfall. Thus the Nile, Congo, Niger and Zambesi rise, and are fed by tributaries which rise, in this belt.

1. The Nile is the longest river in the world. It rises in the large Victoria Nyanza which lies on the equator. It soon turns westwards into a valley where it enters the Albert Nyanza, which is itself fed by a river flowing out of the Edward Nyanza, farther up the valley. The baby Nile is thus fed by large lakes in the rain belt, and that is one reason why its flow is so steady. Leaving Lake Albert at its northern point, the Nile descends by many rapids till it reaches its level plain. Here its current becomes so slow that it is often choked by masses of grass and weed, the haunt of hippopotami. Soon after, its only large left bank tributary enters it. The map shows three important right bank feeders. These flow from the high land of Abyssinia which receives heavy rain in our monsoon season. The Blue or Muddy Nile and the Atbara are two of them. It is these rivers which, rushing down in the monsoon season, cause the Nile floods and give it the mud which it carries. After receiving the Atbara, the Nile has to pass over the next 1600 miles of its course to the sea without any help. Like the Indus, it loses much of its water by the heat of the sun, the thirsty sand through which it flows and irrigation canals. Like the Indus and Ganges it splits up into a fertile delta as it nears the sea. Between Khartoum

where the Blue Nile joins it, and the delta, the Nile flows in a narrow valley with bare rocks and desert on both sides. It passes over no less than six cataracts. Between these cataracts the river is navigable for sailing boats and small shallow steamers.

2. The Congo.—If the Nile is the longest, the Congo is one of the fullest rivers of the world. The map shows its whole basin, unlike that of the Nile, lies in the heavy rain belt. It crosses the equator twice. Like the Nile it takes water from three lakes of the high table-land. But it is unlike the Nile in every other way. Thus it has many and large feeders on either bank. Some of these are as large as the Narbada and Godavari. Its course is not along a narrow valley but over a wide shallow hollow in the table-land. Into this hollow is drained the rainfall of a very rainy area. But, like other African rivers, the Congo has to break through the rim of the table-land before reaching the coast. Here, for over 200 miles we find furious cataracts which prevent navigation from the sea. But for 1000 miles above these cataracts boats and river steamers can make use of the broad and deep river and many of its feeders.

3. The Niger.—This river rises high up in the inner edge of the table-land not far from the sea. But it is forced by the slope to flow away from the coast inland in a big curve, till it finds an opening down to its flat delta at the head of the Gulf of Guinea. The Niger is like the Congo on its right bank, for here it receives feeders from the slopes of the table-land lying in the heavy rain belt. On its left bank it, like the Nile, has a parched and almost rainless desert from which it can get no tributaries till it enters the rain-belt again. Here, about 200 miles from its mouth it receives its largest feeder, the Benue. Like other African rivers its navigation is interrupted by rapids. The Senegal and Gambia, smaller sisters of the Niger, rise in the same part of the table-land, but flow westwards into the Atlantic through damp, hot forests.

4. The Zambezi is a shorter river than the Nile and smaller than the Congo. It flows nearly east across a part of the table-

land which receives less rain than the basin of the Congo, for it is outside the heavy rain belt and gets rain only when the sun is south of the equator in our cold season. The map shows most of its feeders come from the wetter region on its left bank. The river forms a delta at its mouth, smaller than that of the Nile and much smaller than that of the Ganges. About half-way between its source and its mouth the Zambezi pours its waters over a ledge of rock 350 feet high, forming the Victoria Falls. They are one of the most wonderful sights in Africa. The people call them 'The Sounding Smoke.' The roar of the water can be heard for miles, and the spray rises in great columns above the foaming river. The Shiré coming from Lake Nyasa is the Zambezi's most important tributary. The Zambezi, though a large river, is not so suitable for navigation as the Ganges or Irrawaddy. Both it and its feeder the Shiré are, owing to rapids and shifting sandbanks, becoming more difficult to navigate.

5. Other Rivers. The Limpopo or Crocodile River rises in the dry belt of the southern table-land and flows in a great curve into the Indian Ocean. Except during the rains the upper parts are little more than a string of pools of stagnant water. In the mud at the bottom lie the crocodiles which give the river its name. **The Orange River** flows westwards into the Atlantic right across the southern end of the Continent. With its chief feeder, the Vaal, it rises in the Drakenberg ranges where a good deal of rain falls. But only in the rainy season does it have much water. For the last half of its course it, like the Nile and the lower Indus, receives no feeders and becomes smaller by evaporation. It breaks through the rim of the table-land in a twisted course and is of little use for navigation. No vessels can enter it from the sea.

We have already seen that **Lake Chad** is a centre of inland drainage. During the wet season fairly long rivers flow into it and swell the lake to a large size. In the dry season it shrinks to a marsh.

CHAPTER LIX.

AFRICA—Continued.

Vegetation.—The build and climate of Africa explains its vegetation. It has no great ranges of mountains like the Himalayas crossing it. Thus we do not find sudden changes

FIG. 145.—Vegetation map of Africa.

from one kind of country to another, as we do when we cross the Himalayas from the warm, moist, fertile plains of Bengal to the dry, barren uplands of Tibet. Only the northern and southern ends of the continent lie outside the

Tropics. The plants are therefore very like those which grow in India.

1. The Mediterranean Coast.—Here the climate is very dry, and the little rain that comes falls in the winter season from the Atlantic. The Atlas ranges catch most of it. On their outer slopes, facing the damp sea breezes, there are forests of oaks and cork trees. Behind these slopes olive trees and some palms which do not need much rain flourish. In the drier upland parts a kind of grass, called esparto, grows plentifully. It is shipped to Europe to make paper. In the cultivated parts olives, figs, vines and almonds, as well as wheat, barley, maize and a little rice (where irrigation can be had from the hill streams) are grown. The eastern end of the high Atlas table-land produces the finest olives (a fruit which yields fine oil), and the dry country inland the finest dates in the world. The rest of the Mediterranean coast has a much smaller rainfall, and the map shows no rivers except the Nile, and that is fed by distant lakes. Inland from the coast the land is barren, and it gets more barren as we go away from the sea.

2. The Sahara.—As soon as we pass inland we are on the edge of the Great Sahara. This vast, hot, dry desert stretches southwards about half-way to the equator, and from the waterless coast of the Atlantic in the west to the hot, parched rocks and sands of the hilly shores of the Red Sea. We can get some idea of the size of this, the greatest desert of the world, by remembering it is about twice as large as India. The reason for this desert is simply the want of water. Only very little rain falls now and then, and that little is soon sucked up by the fierce sun. The map shows there are no rivers, not even small ones, which have enough water to reach the sea, except the Nile. It is like a hundred Thars in one. During our cold season the winds blow out from the Sahara just as they blow out from the dry high land of Asia. In our wet season the clouds from the oceans cannot reach this desert.

As most of the Sahara is so far from the sea, the days are very hot and the nights are often cold, just as happens on a

small scale in the Thar desert. This sudden change from heat to cold splits up the rocks and this work has been going on for thousands of years. The rocks are thus being constantly worn down into sand and dust. The strong winds blow this sand about, and use it to rub down more rocks. When a sandstorm takes place, travellers are in danger of being choked. Even sailors on steamers in the Red Sea are troubled by these sandstorms.

3. The Oases of the Sahara.—The Sahara is, however. not pure sand and rock. If it were, no one could travel over it. Here and there, just as in the dry parts of Central Asia, there are oases, some large some small, watered by springs. With their help the Arab camel-drivers can find their way, as if on stepping-stones, across the pathless desert. Round the oases-villages grow date-trees, a little grass for the goats and camels, and a little millet. Dates are the chief food of the people. Without the date-palm life on the Sahara would be hardly possible. The Arabs of the desert measure their wealth by their dates and camels.

4. In the south-west of Africa there is another barren region, much smaller than the Sahara, called **the Kalahari Desert**, stretching north of the Orange River. It is as high as the Deccan and is covered with ridges of sand and dried-up water courses. It is becoming drier every year. Here the S.E. Trades blow from the land and are therefore dry.

5. The Heavy Rain Belt. Forests.—The rainfall map shows that a large part of the centre of the Continent has a very different climate, for here much rain falls. The centre of this heavy rain belt is the basin of the Congo, and it stretches eastwards beyond the great lakes, and westwards along the Guinea Coast. Lying on both sides of the equator, this region is also very hot. Great heat and heavy rain produce thick forests here, as in other parts of the world. The vast African forests are very wonderful. The trees grow so close and they are laced together by so many flowering creepers that it is impossible to pass through them except by cutting a path with axes. Every tree and plant has to fight with its fellows

for light. The creepers use the large trees on which to climb up to the sunlight. The forest is thus a mass of thick foliage and dense jungle. The sunlight cannot reach the ground and there it is almost dark. Palms, especially the oil-palm, trees of ebony and mahogany, and others bearing nuts and gum are among the most useful. Only animals that can climb can live in these dense forests. They are the homes of man-like apes and monkeys, of birds and myriads of insects. The people dwell in small clearings in the forest and in villages

FIG. 146.—Zebras in the Savannah lands of Africa.

on the banks of the rivers. They live on plantains and forest fruits, grow small patches of maize, rice and sweet potatoes, and keep a few cattle. The only way of penetrating these immense forests is by boats along the rivers.

6. The Grass Lands.—We have now studied the very dry and the very wet parts of Africa. The rest of the continent is made up of grass-lands. The parts of this grass-land lying next the northern and southern edges of the forest regions, of course, receive more rain than the rest. This part of the grass-lands is called **savannah.** Here grass plants of all

kinds grow very tall and plentifully, and there are many groves of trees, especially near the damp banks of rivers. Grass-eaters such as antelopes, elephants, buffaloes, zebras and giraffes wander in herds over the savannah, and lions and leopards lurk in watch for them round the water-courses.

FIG. 147.—Giraffes on East African Savannah.

As we go farther away from the wet forest belt and nearer to the dry deserts, rain falls for only a short season. Here there is not enough moisture for trees except by river banks. We pass from savannah into **steppe and scrub lands.** The grass becomes thinner and poorer and grows in tufts here and there. There is not enough food for many animals. The wingless ostrich, which can scour for great distances in search of food and live on almost any green plant, finds here a suitable home.

This scrub land gradually merges into the Sahara in the north and the Kalahari in the south.

The part of the African table-land south of the Zambesi and inside the rain screen of the high Drakenberg ranges is a high grassy table-land. It is called the High Veldt or High Grass Land by the Dutch farmers who live there. As we shall see, almost the whole of South Africa is a pasture land. Without irrigation it can never be anything else.

7. The Mediterranean Climate of the Extreme South.—The southern end of the continent, as we saw, has a Mediterranean climate with rains in the cold season and a warm, dry fruit-ripening summer. Hence, on the slopes of the mountains farthest south there are orange groves, peach orchards and vineyards. Cape Colony exports much fruit.

The Animals.—This huge continent has a larger number of wild animals than any other. The forests are full of monkeys. Among them are the man-like apes, the gorilla and the chimpanzee. The gorilla is as big as, and much stronger than, a man. Baboons, or dog-faced monkeys, wander in herds over the high lands, sleeping at night in caves. They kill lambs and are hunted by shepherds. The elephant lives both in forests and in savannahs. As it is hunted for its tusks its numbers are decreasing. The African elephant is different from his Indian cousin. The ears are larger and the legs longer. Both the males and females have tusks. The African elephant, again, has never been tamed and trained to do work. The open savannahs abound in grass-eaters such as antelopes of many kinds, which are cousins of the Indian black buck. Africa is the home of the antelope, which differs from the deer in having hollow horns without branches. The striped zebra, half horse, half donkey, is another grass-eater. Then there are wild asses and four kinds of rhinoceros, which differ from the Indian in having two horns. The giraffe, the tallest of living animals, also has its home in the grass-lands. Its long legs and long neck enable it to feed on the leaves of tall trees. The ostrich, the largest of living birds, cannot fly, but its long legs carry it


10°
0°
10°
20°
30°
40°
50°
SPAIN
MEDITERRANEAN SEA
Str. of Gibraltar
Algiers
Tunis
Sicily
Fez
Mountains
Morocco
Mogador
MOROCCO
ALGERIA
TUNIS
G. of Tripoli
Alexandria
Port Said
Canal
Suez
Cairo
Canary Is
TRIPOLI
(Italian)
Libyan
EGYPT
Assiout
Aswan
R. Nile
RED SEA
ARABIA
Mecca
(Spanish)
Tropic of Cancer
Sahara or Great Desert
Wadi Halfa
Dongola
Port Sudan
Berber
FRENCH WEST AFRICA
Timbuktu
ANGLO-EGYPTIAN SUDAN
Khartum
R. Atbara
Blue Nile
White Nile
Bab-el-Mandeb
Aden
Gulf of Aden
Socotra
(Br.)
R. Niger
L. Chad
Kano
NIGERIA
GOLD COAST
Freetown
SIERRA LEONE
LIBERIA
Accra
Lagos
Duala
FRENCH EQUATORIAL AFRICA
BRITISH SOMALILD
ITALIAN SOMALILAND
ABYSSINIA
Abyssinia
R. Congo
Albert Nyanza
Ruwenzori
UGANDA
KENYA COLONY
Gulf of Guinea
Equator
30
20°
10
0°

ATLANTIC
OCEAN
INDIAN
AFRICA
English Miles
0
500
1000
Benguela
RHODESIA
SOUTH-WEST AFRICA PROT.
BECHUANA-LAND
Walfish Bay
MADAGASCAR
Salisbury
Beira
Lorenzo Marques
Johannesburg
Kimberley
R. Orange
NATAL
Durban
Pietermaritzburg
CAPE OF GOOD HOPE
East London
Port Elizabeth
Cape Town
Cape of Good Hope
20°
10° Meridian of 0° Greenwich 10°
20°
30° Long. East 40° of Greenwich 50°
30°
40°
Emery Walker Ltd. sc.

FIG. 148.

over the savannahs and deserts faster than a race-horse. In South Africa it is bred by farmers for its feathers. Grass-eaters depend on their speed for safety. Lions, leopards and hyenas live near water-courses, where they prey on the grass-eaters such as buffaloes and antelopes. In the deserts and steppes of the north the single-humped camel is used as a beast of burden. The rivers in the hot parts of Africa abound in rhinoceros, hippopotami and crocodiles. The former live on grass and water-plants. The crocodile is a flesh-eater, and lies hidden in mud and water of lakes and rivers in wait for animals coming there to drink. There are hundreds of different kinds of birds. The secretary-bird is protected, for, like our mongoose, it lives on snakes. In such a hot country reptiles such as lizards and scorpions are common. There are thousands of kinds of insects. Locusts often destroy fields of grain. The white ants are even more numerous and harmful than they are in India. Mosquitoes spread malarial fever. The tsetse fly, the bite of which is fatal to all domestic animals, is common in many parts of East and South Africa.

CHAPTER LX.

AFRICA—THE DARK CONTINENT.

We have now studied the position and shape, the build, the climate and rainfall and some of the productions and animals of Africa. We now ask what man has made of this great continent? What use has been made of its coasts, its rivers, its mountains and its soil? Most of us know that Africa is the home of some of the most backward and uncivilized races in the world. The other continents of Europe and Asia have helped civilization a great deal. For example, Asia is the birthplace of the great religions of the world—Hinduism, Buddhism, Christianity and Mohammedanism. Most of the great discoveries in science have been made in Europe. But Africa has scarcely helped civilization at all. It has been the Dark Continent. How did it get this name? Partly, because it is the home of the black negro and partly because it was very difficult to penetrate. The interior of Africa is the most difficult part of the world to reach. Till a few years ago it was quite unknown. No doubt for thousands of years the Arabs have travelled over and sailed along its northern shores as far west as the Atlas Mountains. Egypt, too, the land of the Lower Nile, is one of the very oldest countries in the world. The Egyptians were civilized even before the Aryans came into India. Arab merchants and Arab pirates also knew the Red Sea shore, and traded and hunted and robbed on the African coasts of the Indian Ocean as far south as the island of Zanzibar. But the interior of Africa remained unknown long after North and South America had been discovered and explored. Why was this? If we

remember what we have learned of the shape and climate of Africa we can tell some of the reasons.

In the first place, the whole of the north of Africa is taken up with the greatest desert in the world. The Sahara has thus prevented the fierce wild tribes from Central Africa from coming north into Europe. Europe has been invaded more than once by the Aryans from Central Asia. But the tribes from Central Africa could never reach it. This was a great advantage for Europe. These savage African tribes could not come by sea, for the peoples of Africa have never been seamen or fishermen. They had no peninsulas or islands on their coasts to tempt them to a life on the sea. In the second place, the peoples of Europe and Asia were, in the same way, kept from coming into the centre of Africa. There is only one way to cross the Great Sahara and that is by the help of the camel. The camel can go for long distances over the desert without water. It can feed on the scanty, leathery leaves which grow there. Its flat, padded feet prevent it from sinking in the soft sand. But the camel is not a native of Africa. It was only after the Arab merchants brought camels from their own country that the Sahara could be crossed. These merchants groped their way with their camels, bit by bit, across the desert, from oasis to oasis. In this way the desert parts of the north of Africa became known to the Arabs. At the present day the parts of Africa which do not belong to European nations, *e.g.*, Morocco, Tripoli and Abyssinia are still governed by people of Arab blood.

But even in the other parts of Africa where there is no desert it is very difficult to reach the interior. The map shows us there are no great arms of the sea, like the Baltic Sea or Adriatic Sea in Europe, reaching far up into the heart of the continent. Africa has no great water-gate like the Ganges or Yangtse Kiang or Rhine, leading far up-country by an easily navigated river. Then the coasts are feared by strangers. In some places they are barren and desert so that people landing on them can find neither food nor water. Where the coasts are not barren, they are often very unhealthy. Look

at the Gulf of Guinea. The hot, marshy, feverish jungles of this low-lying coast have been called the Europeans' Graveyard. Hundreds of them have died there from fever. But even after a traveller passes the coast, his difficulties are not over. Almost everywhere in Africa we find the high edge of the table-land facing us as we go inland. From the sea-coast this barrier looks like a range of mountains. In some parts the table-land can only be reached by climbing over two or three of these edges. In other Continents the rivers help us. But in Africa they do not. It is possible to go up the Ganges or the rivers of China for great distances without even seeing a hill or passing a rock. But, as we saw, the rivers of Africa are different. When they cross the rim of the table-land to reach the sea, they form great rapids over bars of rock and through steep and rocky gorges. No boat or steamer can pass over these rapids and cataracts into the interior. This is perhaps the chief reason why Africa remained so long unknown.

But even if we reach the interior of Africa, it is not easy to pass from place to place. The people are not civilized; they only grow enough crops to feed themselves. There are no roads; away from the coasts there are few railways. In the desert the sand would soon cover and blot out any road. On the grass-lands there are few villages; only in the more civilized parts are bullock carts used. The forests of the rain-belt are so dense that paths have to be cut through the jungle of trees and creepers. The marshy places by the river banks swarm with mosquitoes which cause fever. In some parts the wild animals are very dangerous. When, for example, the railway was being made from Mombasa to Lake Victoria, several engineers and coolies were killed by lions, for these fierce animals, unlike the Indian tiger, do not fear to attack man. Sleeping sickness, caused by the tsetse fly, has always been a scourge, and thousands die of it every year in the Congo basin and other parts of Central Africa. This fly is also fatal to bullocks, and there are regions where these cannot be used. We have to remember, also, that the

peoples of Central Africa are mostly savages. Many of them still eat human flesh. For these reasons travellers have found great difficulty in exploring the interior of Africa.

A hundred years ago we knew more about the geography of the moon than about that of the interior of this continent. So, too, the people have been unable to go outside it and visit other countries. For hundreds of years the only inhabitants of Africa who left it were the slaves who were caught and taken off to work in foreign lands.

Still, European and some Indian travellers have gradually explored large parts of Africa. They have been helped by rivers like the Congo and Nile, and by the great lakes. For, though it is very difficult to go up these rivers from the sea, their upper courses can be used by boats and shallow steamers. At the present day almost the whole of Africa is governed by the nations of Europe. They are trying to civilize the people, to teach them crafts and trades, and to educate them. This is a very difficult task. Even at the present day the people of Africa do not help other parts of the world much by trade. Many of them do not even cultivate the ground. They are content to live on wild fruits, roots and the flesh of animals they hunt. Thus Africa sends to the rest of the world very few cultivated crops. Its chief exports are wild products, such as dates and plantains, the palm oil from its oil-palms, the ebony, nuts and rubber from its forests, the ivory tusks from its elephants, the skins of its animals and ostrich feathers. There are no manufactures. The most advanced parts are the countries lying along the shores of the Mediterranean, such as Egypt and Algeria, which have traded with Europe for hundreds of years, and the southern end of the Continent, where it is cool enough for Europeans to settle and improve the country and increase its trade.

CHAPTER LXI.

THE EMPIRE IN AFRICA.

(See coloured map of Africa.)

THE political map shows that large parts of Africa are under the protection of Great Britain, France and Portugal. **Egypt** is no longer a part of the British Empire, for it was made independent in 1922, with a king of its own. But for forty years before that Great Britain was responsible for its government, brought peace into the country and greatly improved its agriculture and its trade. Even now Egypt looks to the British Empire for protection. On the map Egypt looks larger than any province of India, but a great part of the country is desert and only a fraction of the land can be cultivated. The population is therefore small—only about 120 lakhs or less than that of any of the larger provinces of India. But it is very dense for it is all crowded on the fertile delta and banks of the Nile.

"Father Nile" has made Egypt. Every year it is flooded deep by the monsoon rains which fall on the Abyssinian mountains. These old volcanoes are covered with rich lava soil, which is light and is carried down for hundreds of miles by the river, and spread over the fields near its banks and on its delta. At Cairo the river rises 25 ft. We can understand how important these floods are, when we remember that on the delta less rain falls than in Sind. Only where this water reaches can crops grow. Egypt is thus unlike any other country in the world. Without the Nile and without irrigation it would be just a part of the desert in which it lies. The water of the river has been used to water the fields for thousands of years. But during the last forty years irrigation has been

vastly improved, and in consequence the population has doubled. Engineers, who had learned their work on the Punjab rivers, have built great dams across the Nile, of which that at Aswan is the largest. Between November and April the sluices of this dam are shut, so that the Nile above it is turned into a lake about two hundred miles long. This water can be allowed to escape gradually to fill the canals and irrigating

Photo. J. Boyer, Paris

FIG. 149.—Pumping water from the Nile.

channels of middle and central Egypt, and so fertilise an immense area of fields all the year round. Formerly it used to flow into the sea during floods and was lost.

Crops.—For hundreds of years Egypt was the country from which the people living on the Mediterranean coasts got their chief supplies of wheat. The dry climate, helped by irrigation, suits the plant (just as happens in the Punjab), and it can ripen well. Egypt also grows and exports large quantities of raw cotton. Sugar-cane, maize, millet and rice are other grain crops. The date-palm, which grows best "with its feet

in water and its head in fire," thrives well on the Nile banks and in the oases of the desert.

Towns.—As we should expect, the large towns are on the river or its delta. **Cairo**, the capital, is the largest town in Africa, with nearly as many people as Bombay. It stands at the head of the delta and is a Mohammedan city full of mosques,

FIG. 150.—A steamer passing slowly through the Suez Canal. Why slowly?

but its population is very mixed and includes French, Turks, Greeks and Arabs. In the cool season its hotels are full of visitors from Europe, who wish to escape the cold damp fogs of their own countries and to visit the old temples and the famous pyramids, built thousands of years ago. The chief sea-port, **Alexandria**, is at one of the mouths of the Nile and trades with the other ports of the Mediterranean. We might compare it with Karachi. Its name tells us it was founded by

Alexander the Great before he marched on his way to India. On a good map look out **Asyut**, **Aswan** and **Wadi Halfa**. They are the chief trading towns on the Nile. **Port Said** and **Suez** are not on the Nile but on the Suez Canal. Port Said has grown into a large town since the canal was made nearly sixty years ago. It stands at its Mediterranean entrance and is a very busy place, full of warehouses and shipping offices. Here, too, are large stores of coal brought chiefly from England, for Port Said is one of the most important stopping places for ships in the world. Five thousand steamers pass through the canal every year. Here they buy the coal which will feed their engines across the Indian Ocean to Bombay and Colombo, or across the Mediterranean Sea to Genoa, Marseilles, Gibraltar and London. Suez stands at the other end of the canal, but few steamers stop there.

It is very important for Great Britain that she should be friendly with Egypt. She is the greatest sea-nation in the world, with more steamships and trade than any other country. The Suez Canal, one of the most important waterways of the world, passes through Egypt. The King of Egypt has agreed not to interfere with the passage of ships through it. In the Great War, Indian, British and Australian troops guarded the canal against the Turks and Germans who tried to destroy it.

The Anglo-Egyptian Sudan.—This country lies south of Egypt and extends from the twenty-second parallel of latitude, where rain seldom falls, nearly to the equator, which is in the belt of summer rains. It is more than half the size of India, but, as large parts are desert, the population is small – only about four times that of Bombay city. The Nile is the chief waterway between Egypt and the Sudan. Small steamers and sailing vessels can use it in the long intervals between the cataracts for hundreds of miles right up to Khartoum and beyond it. The Nile valley is also the route followed by the railway. Lines join Alexandria, Port Said and Suez with Cairo. From Cairo the main line runs up the valley to Aswan. It will be continued to Wadi Halfa, from which the Sudan

Photo. The Exclusive News Agency

FIG. 151.—Entrance to the Suez Canal at Port Said. The offices of the Suez Canal Company are in the middle of the picture.

railway runs south to Khartoum, through Berber. From **Berber** a branch line goes to **Port Sudan** on the Red Sea.

Khartoum, the capital, has, like Patna or Allahabad, a fine situation. Here the two Niles meet. The city is bound to become a large town, for it is the meeting-place of trade on these two rivers. The railway has been built for a good distance to the south. It is also the centre of a vast savannah country which stretches south as far as Uganda. To it are brought boat-loads of cotton grown in the doab of the two

Photo Underwood aad Underwood.

FIG. 152.—The Khartoum Bridge over the Blue Nile.
(The river is in flood; for the photograph was taken in August.)

Niles, gum arabic from the desert, ivory from the elephants hunted in the grass lands, and ostrich feathers, dates from the oases, and skins and hides from the cattle bred on farms in the pasture lands to the south. The Sudan is the chief source of the world's supply of gum arabic and ivory.

British East Africa (Kenya Colony).—Sailing from Suez or Port Sudan down the Red Sea and along the Gulf of Aden, we might touch at Berbera, the chief town and harbour of the unimportant province of British Somaliland, and then steer eastwards between the rocky barren island of Socotra and the great horn of Africa into the Indian Ocean. Continuing our voyage southwards along the coast we reach **Mombasa**, built

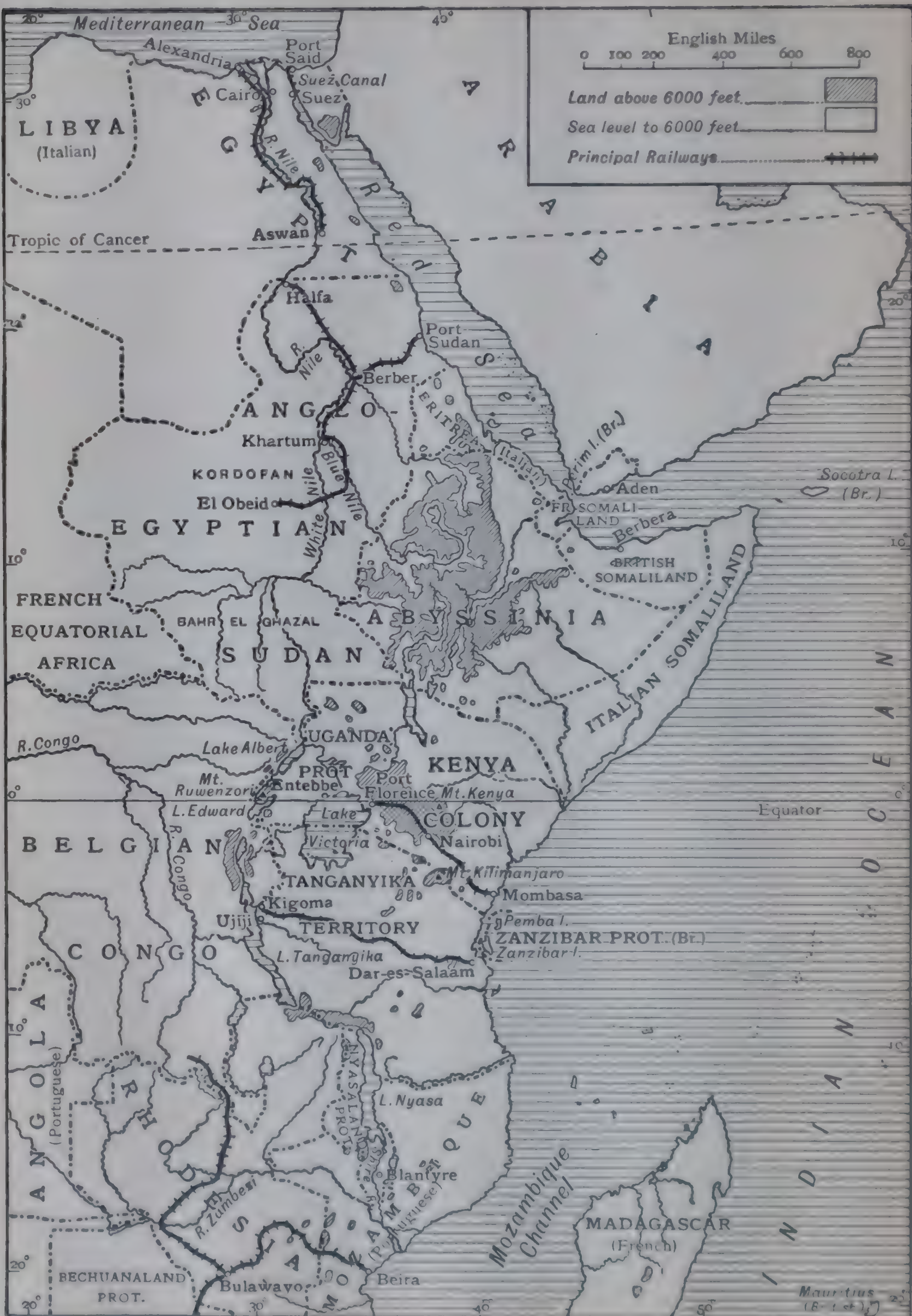

FIG. 153.—Egypt, Anglo-Egyptian Sudan, Kenya Colony and Tanganyika Territory.

on a small island like Bombay. A new harbour, the best on this coast, is now being made on the more sheltered side of this island. Mombasa is the sea-gate of the new Kenya Colony, which stretches inland across the table-land to Lakes Victoria, Albert, Edward and Rudolf.

A railway runs from Mombasa past **Nairobi,** the chief town, to a port on Lake Victoria. Here we find steamers trading on the lake. Although the equator crosses the country, yet the table-land is so high that one is glad of blankets at night. This line joins the Indian Ocean with the heart of Africa. It is one of the most wonderful in the world. The engineers had to cross feverish swamps and a waterless desert, to cut a way through dense forests, bridge mountain torrents and dig a pathway along steep slopes. Sometimes the work was stopped by fear of the fierce lions that are very numerous in the district. The wild naked negroes were found to be of no use in making the lines. So, thousands of Indians (chiefly from the Punjab) were brought over with trained surveyors, draughtsman and clerks of the higher castes. Many of these have remained on as station-masters and railway servants. By making this line these Indians helped to kill the slave trade of East Africa. On the low-lands of the coast, where there is sufficient rain, rice, coco-nuts, sugar-cane and ground nuts are the chief crops ; maize and cotton on the table-land. There are many large and valuable forests.

From Mombasa it is not a long voyage to **Zanzibar**, a large coral island, where we anchor in a good harbour. Zanzibar and Pemba Islands are the chief suppliers of cloves to the rest of the world. Coco-nuts are also largely exported. Most of the trade is in the hands of baniyas from India.

Not far south we come to **Dar es Salaam**, the chief seaport of the country which, before the war, was called German East Africa. It is now under British protection and is called by its new name **Tanganyika Territory.** A new map shows it stretches inland from the coast and across the table-land, and touches Lakes Victoria, Tanganyika and Nyasa. From Dar es Salaam a railway takes us inland through grass-lands and

forests to a harbour on Tanganyika Lake. We pass through ranges of mountains. Some of them are old volcanoes.

South Africa: Map Study.—Sailing far south we come to the broad belt of British territory which takes up the centre of the peninsula of Africa. It stretches northwards to the shores of the three lakes, Nyasa, Tanganyika and

FIG. 154.—The Veldt of South Africa.

Mweru. We can enter it from the sea in the far south. At once we see how different it is from Egypt, the land we entered from the north. Here there is no river or valley to help us. The rivers do not run north and south but east and west. The African table-land in the south is fenced off from the sea by high ranges of mountains running close to and parallel to the coast. If we go inland by railway from Cape Town, we have to climb up three or four great steps, first

the shore slope, then the Little Karoo, then the Great Karoo and lastly the high veldt or table-land. If we try to get inland from Natal the climb is still steeper. The railway from Durban climbs 2000 feet in the first thirty miles. Thus the high edge of the table-land is a barrier to people entering it from the coast. The railway lines have to be cut along the

FIG. 155.—A herd of Ostriches on the grass-lands of South Africa.

steep sides of the hills. Without them the interior of South Africa would be cut off from the sea altogether.

The Pasture Lands of South Africa.—The Drakenberg Mountains are like the Western Ghats. They stop the rain-clouds brought by the S.E. Trades from the sea. The table-land behind them therefore receives little rain. In the short wet season the grass and flowers spring up quickly, but during the long dry season there is nothing but dried-up grass to be seen and a few bushes. There are very few trees except on the banks of the rivers. Irrigation is very difficult. The whole of

this great high tract of table-land, from the coast in the south to the banks of the Zambezi in the north, is, therefore, a rather poor pasture country. It feeds cattle, sheep, goats and horses. As there is little grass except in the rains, the farms are widely separated to allow the animals sufficient pasture. Every farmer must keep and ride horses if he is to visit every part of his large farm. It is quite different from India where farms are small. Many ostriches are reared from eggs and kept like sheep. Their feathers are very valuable and are much used for ornaments in Europe. The farmers grow a little wheat and maize in suitable places, but irrigation is impossible in many parts. Like the Deccan, South Africa suffers from want of rain. Being a pasture country, it exports wool, hides, skins and tallow, also ostrich feathers.

On the low-lying coast strip of Natal it is different. It reminds a visitor from India of the Konkan Coast. There is a good rainfall, brought by the S.E. Trades, and good crops of sugar-cane, maize, tobacco, plantains and other fruits and vegetables are grown. In the south coast the slopes facing the sea have a Mediterranean climate, and there are many vineyards and orchards. The wine made from the grapes is not so fine as that of France and Spain.

The Union of South Africa: Map Study.—The part of South Africa belonging to the British Empire is divided into two by the Limpopo river. North of this river lies Rhodesia. To the south stretch the four provinces of the Union of South Africa—**Cape of Good Hope, Natal, The Orange Free State, the Transvaal, and the new Protectorate of South West Africa.**

The Cape of Good Hope Province takes up the whole of the southern end and stretches northwards to the Orange river. The Drakenberg and other ranges running parallel to the coast must first be crossed by the traveller going inland, and then the African table-land stretches before him. It slopes to the west as we can see by the course of the Orange and its feeders. As, during most of the year, South Africa receives little heavy rain, the smaller rivers are generally dry water-courses, useless for navigation or irrigation. The province is a

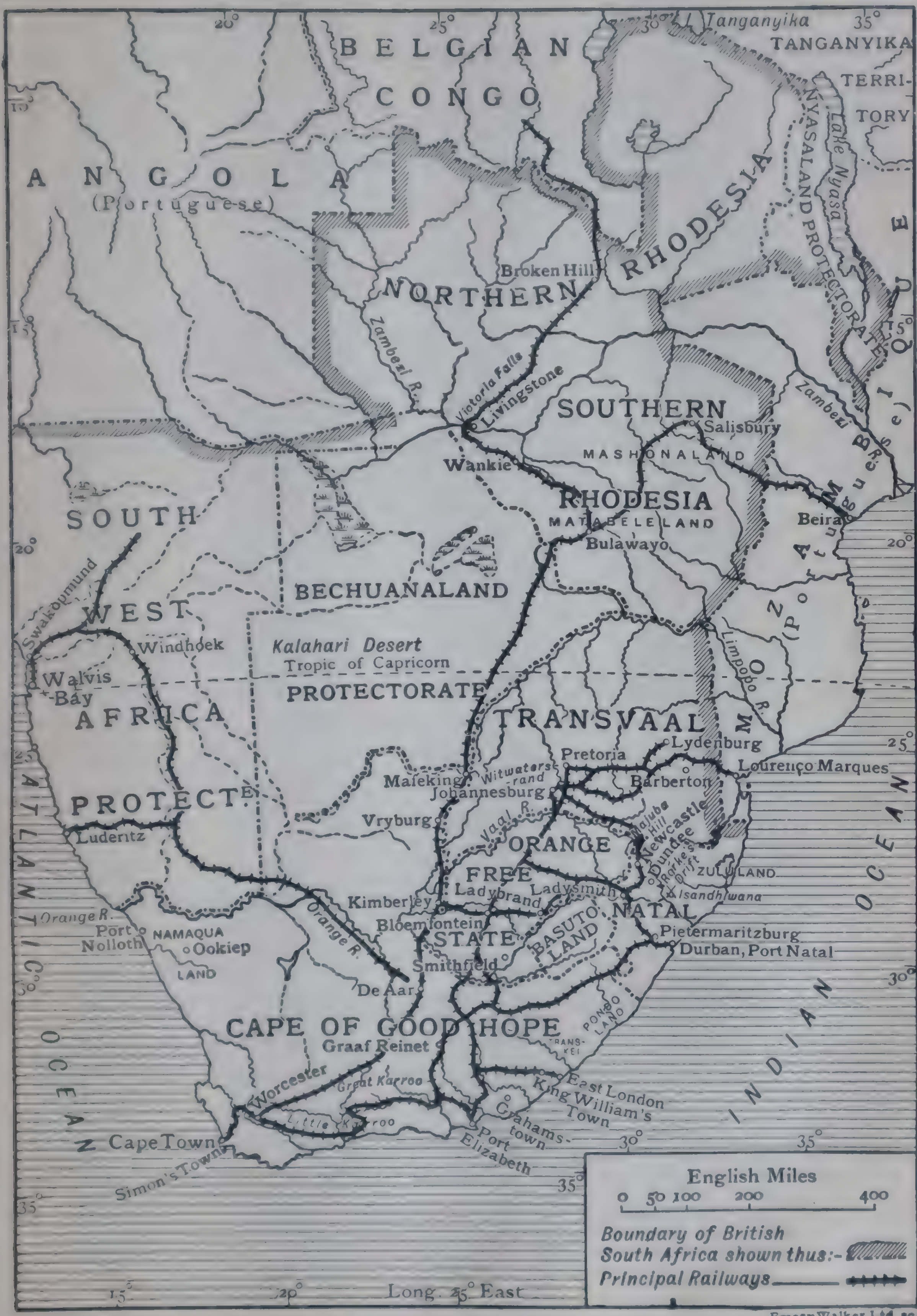

FIG. 156.—The Union of South Africa and the Rhodesias.

country of high pasture lands. **Natal**, a much smaller province, lies between the sea and the high ranges of the Drakenberg. The narrow coast strip gets good rain and Natal has been called the 'Garden of South Africa.' As we saw, rice, sugar, plantains, tobacco and pine-apples grow well. Tea is grown on the slopes inland. When we climb beyond the plain up the mountains we reach the high table-land where there is good pasture for cattle, but not enough rain for much cultivation. **The Orange Free State**, lying between the Orange and its tributary the Vaal, is a high part of the table-land, much higher than the Deccan. For eight months of the year very little rain falls. Thus the farmers there depend on the pasturing of cattle. **The Transvaal**, *i.e.* the country beyond the Vaal, is also a high part of the table-land, covered for most of the year with thin grass. But on the banks of the Limpopo valley the climate is hotter. Here we leave the cooler and drier parts of the table-land and reach a marshy and less healthy country with tall grass and thick forests. The breeding of cattle is the chief business of the Boers or Dutch farmers.

Towns and Seaports of the Union.—In a pastoral country such as South Africa we do not expect to find many manufacturing or large towns. The people belonging to the country, chiefly Zulus and Kaffirs, live in rude huts in country villages, pasturing cattle and growing a little millet. The total population is not large, as but little corn and food crops can be grown. About one quarter of the inhabitants are Europeans—chiefly Dutchmen and Englishmen.

Four of the chief towns lie on the coast—**Cape Town, Port Elizabeth, East London** and **Durban. Cape Town**, the capital of the Union and the chief seaport, stands on Table Bay which faces north. Its position makes it important, for it is a stopping place for ships going round between the Atlantic and the Indian Oceans, and all mail steamers from England to South Africa and Australia put in here. Most of the sea trade of the Union passes through it. From it are sent out the wool, hides, skins, ostrich feathers and dairy produce of the pasture-lands behind it, the wine made near by, and the gold.

diamonds and copper of the mines up country. From England and Europe come manufactured goods of cotton, iron, steel, machinery, etc. They are sent inland by the main line of railway which climbs up the slopes of mountains and crosses the table-land in the north. **Port Elizabeth** and **East London**, farther along the coast, are other ports sharing in this trade. Durban, the port of Natal, is a coaling-station, for there are rich mines at **Newcastle.** Some of this coal is shipped to India. The chief railway lines climb up into the table-land from these ports. The one from Durban passes through **Pietermaritzburg,** the capital of Natal. **Bloemfontein,** the chief town of Orange Free State, lies near the centre of the province and is a meeting-place of railways. It is only a small place where the farmers round about sell their cattle and buy foreign goods. **Pretoria,** the capital of the Transvaal, is also a meeting-place of railways. Almost all the inland towns of the Union are markets of pastoral districts. Two others are important for another reason, South Africa is rich in minerals, and the Transvaal has the largest gold mines in the world. Along a ridge of hills called the Rand, not far south of Pretoria, rocks containing gold run for miles under the surface, and the gold is very evenly spread through these rocks. Here a large town, **Johannesburg**, has sprung up, the largest and busiest city in South Africa. It is much larger than Kolar, for its mines are richer. On the way to Johannesburg from Cape Town the railway passes through **Kimberley**, which is the largest diamond-mining centre in the world. Johannesburg (gold), Kimberley (diamonds), and Newcastle (coal), are thus three important mining places in the Union.* **The South-West Africa Protectorate** which, before the Great War, belonged to Germany, is now under the Union of South Africa. It stretches inland from the Atlantic north of the Orange river. This is a very dry region for the South-East Trades blow from the land. As we climb inland from the coast we find ourselves on the borders of the Kalahari Desert. From **Walfish Bay**, the chief seaport, a railway runs south to join the main line from Cape Town to Pretoria.

* Deposits of platinum have recently been found.

Rhodesia : Map Study.—Beyond the Limpopo lies another large area of British territory. The part to the west is the **Bechuanaland Protectorate**, with no towns and few people, for the climate is very dry and the Kalahari Desert fills up a large part of it. The rest of this territory lying between the Transvaal in the south and the borders of the Congo State and Tanganyika Territory on the north, and separated from the coast by Portuguese West Africa, is Rhodesia. The part south of the Zambesi is **Southern Rhodesia**, the part to the north, **Northern Rhodesia.** Southern Rhodesia became a Dominion of the Empire in 1923 and Northern Rhodesia a Crown Colony like Ceylon. It consists of a high table-land with grassy hills, drained in the south to the Limpopo and in the north to the Zambezi. We are here getting nearer the equator and the heavy rain belt. Therefore the grass grows more plentifully and there are forests on the banks of the rivers. The population is scanty and the people live by grazing cattle and cultivating a little maize. There are several gold mines and the country contains many minerals. The railway from Cape Town runs through both parts of Rhodesia a distance of over 2000 miles. It passes through **Bulawayo,** then strikes north-westwards over the Zambezi, which it bridges at the Victoria Falls, and goes on to the Congo border. From Bulawayo a line branches off to **Salisbury**, the capital of Southern Rhodesia, and a line from Salisbury runs down to Beira, a seaport in Portuguese Africa. The best way to understand the geography of South Africa is to study the railways. The **Nyasaland Protectorate** extends along the western and southern shores of Lake Nyasa, and on both sides of the Shiré, feeder of the Zambezi. The chief place is **Blantyre**, among the hills. It is a centre of missionaries who teach the people and try to civilize them. From Blantyre we can get by river and train to Chinde, a Portuguese port on the Zambezi delta.

British West Africa : Map Study.—The map shows several parts of the North Guinea coast belong to the British Empire. They all lie in the hot rainy belt,

and are therefore full of marshes, jungles and forests. We may compare this coast with that of Malabar. The people are negroes and are still very backward. They live on the wild fruits of the forest, by hunting and fishing, and if they cultivate fields of rice and maize, they only grow enough for their own wants. The heat and damp make these West African colonies, especially the parts near the low, flat, marshy coasts, very unhealthy. Only a few Europeans venture to live there. They are chiefly merchants and traders in the coast ports, who import the manufactures of Europe and send back in exchange the wild products, which are brought down the many rivers and creeks by boats. These products are palm-oil, wild rubber, nuts, bees-wax, timber, tin, hides and skins, and a little gold dust. The Guinea coast is the chief market for palm-oil in the world. It is got from a nut different from, but not unlike, the coco-nut. The delta streams of the Niger are thus sometimes called 'the oil rivers.' In recent years cocoa has been very largely grown. The hot, damp climate suits the growth of the tree exactly, and now more cocoa comes from this coast than from any other part of the world.

Southern Nigeria stretches over and behind the delta of the Niger. The coast is a network of creeks and backwaters like Malabar. Here is the home of the oil-palm. Ground nuts, cocoa and rubber are other products. **Lagos**, on a small island on one of the creeks, is the largest town and one of the busiest harbours on this coast. A railway has been built to join it with towns and villages in Northern Nigeria.

Northern Nigeria stretches inland as far as Lake Chad, and is much higher, drier and therefore more healthy, than the low-lying coast and delta. The tribes collect rubber, gum, and oil-seeds and send them to the coast in exchange for cotton goods brought from Europe. Northern Nigeria now grows large crops of cotton, and along with Egypt and the Sudan is one of the chief suppliers of raw cotton in Africa. There are large deposits of tin. **Kano**, a busy trading city inhabited by negroes, is one of the most important markets of Africa. Here the trade of the desert meets the trade of the savannah

and forest lands of the south. Across the desert come camels laden with dates and salt; from the grass-lands herds of cattle; from the coast manufactured goods from Europe, brought by rail from Lagos.

Sailing westwards along the low-lying coast past many small ports. we reach the **Gold Coast Colony**, of which **Accra** is the chief harbour. It exports cocoa, kola nuts, palm oil, timber, rubber and some gold. A railway runs inland for some 200 miles. Ships from Britain and Europe bring cotton goods, iron and steel manufactures and coal.

Sierra Leone and Gambia are two small territories belonging to the Empire. **Freetown**, the greatest seaport in West Africa, has an excellent harbour and is a coaling-station for ships. It is the seat of Government of Sierra Leone, and is connected inland by a railway. **Bathurst**, the capital of Gambia Colony, which stretches inland on both banks of the Gambia River, is an island seaport like Bombay.

All these West African colonies have a warm and moist climate, and in time they should produce crops for export. The inhabitants are Sudanese negroes, many of whom are Mohammedans. They only grow enough crops for their own use. The exports, as we have seen, are chiefly wild products such as palm-oil and nuts, rubber, ivory, mahogany collected in the forests, bullock hides and some gold. West Africa exports more cocoa than the West Indies. These are brought down by road, river and railway to the many ports to be sent abroad. In return come manufactured goods from Europe. British officers, helped by the head men of the country, are developing the country by making roads and railways, and setting up schools, hospitals, post-offices and courts of justice. The old slave trade has been stopped.

St. Helena and Ascension are volcanic islands far out in the Atlantic. Steamers touch at them on the way from London to Cape Town. **Mauritius** island, 500 miles east of Madagascar, grows large crops of sugar-cane, much of which is exported from **Port Louis** to India and Europe. There are many Indians on the island.

India and the East Coast of Africa.—Bombay and other Indian ports carry on a good deal of trade across the Indian Ocean with the opposite coast of Africa. Steamers sailing to Europe touch at Aden in Arabia. Here they leave cargo, such as cotton goods and rice, which is picked up by smaller vessels trading with small ports in Somaliland and the African coast of the Red Sea. Other vessels trade to Mombasa, Zanzibar island and Dar es Salaam. From Mombasa they carry back cotton brought from the uplands of Uganda by the railway running up to the shores of Lake Victoria. At Zanzibar they can take on board a cargo of cloves. At Dar es Salaam more cargoes are waiting for them which have come by the railway joining this port with Lake Tanganyika. Farther south, Beira, at the mouth of a river a little south of the Zambezi river in Portuguese East Africa, is a growing seaport. From it one line runs nearly straight inland up the table-land to Salisbury in Rhodesia and connects with the railways of the Union of South Africa. Another line has been built from Beira, north-westwards to the Zambezi. Here a ferry across the river joins it with a line which runs up the Shiré valley to Blantyre. It will be continued to Lake Nyasa to a harbour where lake-steamers will meet it. Still further south, steamers from Bombay touch at Laurenço Marques, from which a line climbs inland to Pretoria and joins the railway from Cape Town. By sailing still further along the coast they can trade with the seaports of Durban, East London and Port Elizabeth. As these lines joining the seaports with inland towns and villages extend, the trade between India and Africa is bound to increase. Many Indians live and trade in these African ports.

Cecil Rhodes, a statesman who gave his name to Rhodesia, formed in 1889 the idea of having a railway line to join Cape Town with Cairo. This line would pass through countries belonging to the Empire for almost its entire length by way of Buluwayo, crossing the Zambezi at the Victoria Falls, connecting with harbours on the Great Lakes of Africa, and joining the line which runs southwards up the Nile Valley to

beyond Khartoum. In this way the north and south coasts would be connected. This line has reached a feeder of the Congo. But this is not the best way to open up the trade of a large continent. It is easier and cheaper to make separate lines running inland from the chief harbours. The modern geography of Africa is best understood by tracing the lines which run inland from Alexandria, Port Sudan, Mombasa, Dar es Salaam, Beira, Laurenço Marques, Durban, Port Elizabeth, Cape Town, Walfish Bay, Benguela and Lagos, and remembering the chief exports and imports of these harbours. From the island of Mauritius, far out in the Indian Ocean, ship-loads of sugar are brought to Bombay, which sends, in exchange, cotton goods and rice for the Indian farmers who grow the sugar.

CHAPTER LXII.

OTHER POLITICAL DIVISIONS OF AFRICA.

French Africa : Map Study.—If we leave out the British Colonies on the Guinea coast, we can say that the French rule over roughly the whole of the round shoulder of Africa from the Atlas Mountains to the right bank of the Congo. This vast territory includes almost the whole of the Sahara and the upper and middle course of the Niger. Near the great bend of this river stands **Timbuktu,** which, like Kano, is the meeting-place of trade-routes. Caravans of camels come across the desert . Boats and small steamers can reach the town from up and down the Niger, and a railway has been built joining a port on this river with a port on the Senegal. The town is thus the market for a large trade. It has been called 'the meeting-place of the camel and the canoe.' Arab traders bring dates, gum and ostrich feathers across the desert. Goods from Europe, such as tools and beads, come on camel-back from a seaport in distant Morocco. A yearly caravan of 8000 camels brings salt from the desert. Steamers coming up the river carry grain, gold, wax, ivory and coarse country cotton goods. From Senegal come other goods.

French Equatorial Africa, between the Congo and Nigeria, lies in the heavy rain belt, and so produces palm-oil, rubber and ivory. By the Peace Treaty after the war France acquired from Germany the neighbouring territory of Kamerun, and most of the up-country part of Togoland.

Algeria and Tunis are, however, the most important of the French colonies in Africa. They take up a large part of the

Atlas region. They have a Mediterranean climate with little rain except in the winter. France has improved this part of Africa by making harbours, roads and irrigation works, and by giving the people good government. **Algiers** is the chief town and one of the busiest ports on the Mediterranean. Steamers trade between it and Marseilles, carrying wine, tobacco and some wheat. To the French also belongs the large island of Madagascar, 260 miles off the south-east coast. It is a high table-land with a low flat coast covered with forests of palms, bamboos, baobabs and tamarinds.

Portuguese Africa. — The Portuguese were the first Europeans to explore the coasts of Africa. Much the most important part of Portuguese territory is **Angola,** lying south of the Congo. Its build is just the same as that of most parts of Africa. There is a low-lying coast-strip, and behind this we climb up the steep edge of the table-land. Here coffee is grown.

Loanda, the capital, and **Benguela** are seaports exporting coffee, rubber, wax, palm-oil and hides. From them railways run inland for many miles. The line from Benguela has been built to meet the Cape to Cairo railway, which has now been carried as far north as the upper waters of the Congo.

Portuguese East Africa, facing the Indian Ocean opposite Madagascar island, stretches inland on both sides of the Zambezi. Owing to the heat and the heavy rainfall brought by the south-east trade winds, the country is fertile and there are many forests. We should notice three ports on this coast which are inlets and outlets of trade. **Chinde**, on a mouth of the Zambezi delta, is the inlet for trade up this river and the Shiré to Blantyre. **Beira**, a port at the mouth of another river, is joined by one railway to Salisbury and Bulawayo. Another line has now been made to join it to Lake Nyasa. Farther south the safe harbour of **Laurenço Marques** is the sea-end of a line to Pretoria. The Cape Verde and Madeira Islands belong to Portugal: the Canary group to Spain. Italy governs three detached parts of the continent—Tripoli

on the north coast, a strip along the southern shore of the Red Sea, and another strip south of the horn of Africa.

The Congo Free State and Independent Africa.—The vast country of the Congo Basin is the independent Congo State, and the King of the Belgians was in 1885 proclaimed its ruler by the European nations. The whole country is covered with dense forests full of oil-palms, rubber, teak and ebony trees, and ivory is got by elephant-hunters. These forest products are taken down the river to **Leopoldville**. Here its rapids begin. So they are put on railway wagons which take them down past the rapids to a river port, where steamers can come up the Congo and ship them to Europe. Though the hot damp climate is feverish, the State is thickly populated by tribes of negroes, many of whom are still cannibals.

The two chief countries not ruled by European nations are **Abyssinia and Morocco**. The former is a high table-land with a steep slope to the hot and sandy Red Sea coast, and a gentle slope westwards to the Nile valley. Morocco, governed by a Sultan, occupies the western end of the Atlas region. The government is not good. There are no railways nor proper roads. **Morocco** town and **Fez** are two of the Sultan's capitals. The country is now a protectorate of France. **Liberia** bordering Sierra Leone is a negro republic.

The People of Africa.—By far the greatest part of Africa is inhabited by the negro race. Few people in our province have ever seen a negro; you may sometimes see negro firemen on board steamers in Bombay harbour. Once you have seen a true negro you can always recognise one. He has a long narrow skull, a broad and very flat nose, the very opposite of our Indian noses, thick lips and short woolly, curly hair. His skin is not brown but coal black. But just as Aryan races such as Sikhs, Englishmen and Spaniards differ among themselves, so do the various tribes of negroes. Here and there in the Congo forests there are tribes of dwarfs or Pygmies whose tallest men are not more than four feet six inches in height. The negroes of Africa can scarcely be said to have any religion at all. They worship

devils and ghosts. Many have become Mohamedans, and a few Christians. In the north of Africa there are two branches of the white race which are believed to have come over from Asia in early times. The Arabs and Egyptians belong to them. They are Mohamedans. There are few Europeans in Africa, though the countries of Europe rule almost the whole continent. The climate does not suit the European. Only in the far south, in the cool shores and table-lands of South Africa, can he find a home. Here many of the farmers are of Dutch blood. On the east coast there are a few people from India. Parsee, Mohamedan and Hindu merchants are to be found in all the seaports along this coast. In Natal hundreds of Hindus earn their living as traders, shopkeepers and gardeners.


AUSTRALIA
English Miles
0 100 200 300 400 500
Principal Railways
120°
130°
10°
20°
30°
40°
110°
120°
Longitude East 130
Port Darwin
INDIAN OCEAN
WESTERN AUSTRALIA
GREAT
AUSTRALIA
DESERT
Tropic of Capricorn
Shark B
Kalgoorlie
Coolgardie
Fremantle & Swan R
Perth
Albany
Great
Australian


Torres Strait
C York
NEW GUINEA
Gulf of Carpentaria
Great Barrier Reef
Great Dividing Range
Townsville
QUEENSLAND
Rockhampton
Mount Morgan
Brisbane
NEW SOUTH WALES
Broken Hill
Silverton
Darling R.
Murray R.
Bathurst
Newcastle & Hunter R.
Sydney & Port Jackson
Botany Bay
Blue Mts.
CANBERRA
Adelaide
VICTORIA
Bendigo
Ballarat
Melbourne
Port Phillip
Australian Alps
Bass Strait
TASMANIA
Launceston
Hobart
PACIFIC OCEAN
140°
150°
10°
20°
30°
40°
Emery Walker Ltd. sc.

CHAPTER LXIII.

AUSTRALIA.

Map Study: Position and Outline.—AUSTRALIA means Southern Land. This name was given it by its discoverers who came from Europe. This island-continent, as a world-map shows, lies in very much the same latitude south of the equator as India does north of it. Fremantle, the nearest port to India, is about 3300 miles south-east of Colombo. The coast-line is easy to draw and to remember. The northern coast is broken by the large Gulf of Carpentaria, with a broad peninsula on the west and a sharp-pointed one on the east. The south coast bends inland in a much broader gulf called the Great Australian Bight. At its eastern end Spencer's Gulf and St. Vincent Gulf run far into the land. On the latter stands Adelaide, one of the chief towns. Opposite to Tasmania Island the Bass Strait sends a small but important arm of the sea northwards. This is Port Phillip, at the head of which stands Melbourne, the largest town and one of the chief seaports. But, on the whole, Australia looks very solid. As in India and in Africa, the want of deep openings into the land makes it difficult to reach the interior from the coast. Large parts are far from the ocean and are therefore dry. The coast has, however, one feature which no other continent possesses. This is the Great Barrier Reef of coral, about 1200 miles long (as far as from Palk St. to the Ganges delta), lying twenty or thirty miles off the north-east coast. Here the tiny coral worms have built up, on a slowly-sinking sea-bottom, a crust of coral 200 or 300 feet deep. The force of the waves has broken off

masses of this coral and piled them up until the reef in many places forms low-lying islands. Our Laccadive Islands have been formed in the same way. Outside this reef a great storm may be raging, but between the reef and the shore the water is calm, and this helps the sea-traffic along the coast. This calm water makes a good fishing-ground for pearls and turtles.

Map Study : Shape and Build.—The continent is a great table-land, not quite as high as the Deccan, with ranges of mountains rising from it which can be studied best from the map. Between the Gulf of Carpentaria and the Spencer and St. Vincent Gulfs, this table-land sinks to a broad hollow. Part of it is drained into Lake Eyre which lies below sea-level. The rest of this hollow is the basin of Murray River and its feeder, the Darling. On the Pacific and Indian Ocean coasts the table-land comes close to the sea. All along the Pacific coast stretches a broad ridge of land made up of hills and mountains. In the south-east corner, where it is highest, are the snow-covered Australian Alps. Farther north, inland from Sydney, are the Blue Mountains. Still farther north are the Darling Downs and the Queensland Highlands. The whole of this high-land running along the Pacific Coast is often called the Dividing Range. It has a steep slope to the sea and a longer and gentler slope inland. The coast rivers are, therefore, shorter than those flowing inland.

Climate, Rainfall and Rivers.—Though no part of Australia touches the equator, no part of it lies far south of it. The Tropic of Capricorn passes across the middle, just as the Tropic of Cancer passes across India. The central part, being far from the sea, is very hot during the hot season (our cold season) and is largely desert and scrub. In the cool season very little of Australia is really cool—only the south-east corner and Tasmania. Even here snow hardly ever falls except on the Australian Alps.

The rainfall map shows the rain is very unevenly spread. The north part receives heavy monsoon rains in its hot season.

just as we do in ours. Its monsoon comes from the north-west, ours from the south-west. During the hot season the south-east trade winds bring heavy and steady rain from the Pacific. The Great Dividing Range prevents the rain clouds from blowing far inland. Thus, while the Pacific Coast receives good rain and its rivers are flooded, only a little falls on the inland side of the Great Dividing Range, and very little reaches the

FIG. 158.—The way across the Central Desert.

middle of Australia. The Central Plains are drier than the driest part of the Deccan. Here no real rivers rise. After rain a few streams carry water, but for the rest of the year they are dry. The western coast receives but little rain, as here the south-east trades blow from the land. In the cold season the north and centre of the continent is very dry, but the south, especially the south-east and south-west corners, has a Mediterranean climate, rain being brought by the westerly winds. There is a very simple rule by which to remember the rainfall. No matter from what part of the coast

we start, the nearer we go to the centre of the continent, the less rain falls.

Rivers.—Those flowing into the Pacific from the Great Dividing Range have a short course, but, owing to the steady rainfall, they have water all the year round. Sometimes they are deeply flooded. The rivers flowing inland from the

FIG. 159.—Rainfall map of Australia.

Great Divide are longer and slower, but owing to the scantier rainfall, they carry much less water. In the long dry season they shrivel up or altogether disappear. The Murray River is an exception. It rises in the Australian Alps, the highest peaks of which are always covered with snow. This melting snow supplies the Murray with water all the year round. Its chief tributary, the Darling, drains a large area. On the map it looks a large river. So it is in the rains, when it is navigable by shallow steamers for 1000 miles. But in the

long dry season its feeders dry up. The Murray enters the sea in a shallow, useless lagoon like the Rann of Cutch.

On the north coast there are many monsoon-fed rivers but, as few people live there, they are at present of but little use. On the west coast the Swan River flows through the city of Perth. On the south coast for more than a thousand miles no river at all enters the Bight. Thus Australia is poorly supplied with rivers. Not one is nearly so useful as the Ganges. Many of those we see marked on a large map nearly dry up in the dry season. This is a great disadvantage for Australia. Instead of using river waterways to take him far into the interior, man has here to build roads and railways over the mountains and across the parched plains. This is one reason why all the important towns of Australia are on the sea-coast or near it. The want of rivers prevented the interior of Australia from being explored for hundreds of years. At one time it was thought that far inland there might be a great sea or lake with fertile land on its shores. Many men perished in an attempt to find such an inland sea. It was found that the interior is in many places a dry, parched desert, or poor steppe with a few swampy spots in the hollows. These hollows are flooded once in two or three years for a few weeks. Usually they are mere mud holes, surrounded by salt marshes. Australia was found to have a dead heart. But many Australians say, "What does it matter if no rains fall and no rivers flow over large parts of the interior? Perhaps we may find water in plenty below the surface."

Vegetation.—The rainfall map explains the vegetation. The wet tropical forests of timber trees, palms, bamboos, canes and creepers are found in the monsoon area round the shores of the Gulf of Carpentaria, and on the north-east coast. Many plants, too, which are well known in India, such as plantains, rice, indigo, sugar-cane and tobacco can be cultivated in these hot regions. The best known of Australian trees is the Eucalyptus or blue gum, useful for all kinds of carpenter's work. Its oil is used as a medicine. Seeds of this tree have been planted in parts of India. Eucalyptus

forests are found in the well-watered coastal regions of the south-west corner, where the rain is brought by the stormy westerlies of the cold season, and along the eastern shores, where the south-east trades bring rain from the Pacific. In Western Australia the karri and jarrah trees grow to a great height.

FIG. 160.—Natural Vegetation map of Australia.

Much of this timber is brought to India and Ceylon to be used as railway sleepers, for the white ant leaves it alone. As we go inland from the rain-fed parts of the coast, we come to pasture-lands with few trees except on the banks of streams. Farther inland we reach treeless steppes of poor pasture, which merge into scrub, and the scrub into desert. The

pasture-lands have in many places been ploughed up into wheat fields. The native plants of Australia are unlike those found in other parts of the world. Separated from other lands by wide oceans, it had plants and animals of its own. The European settlers brought with them many kinds of trees, fruits and seeds, especially corn-seeds such as wheat, oats and barley, which now give rich harvests.

The Animals.—When these settlers first came, they found no horses, cattle, sheep, or goats, and no animals they could

FIG. 161.—1. Kangaroo. 2. Platypus. 3. Dingo. 4. Wombat. 5. Emu

tame. The native animals they had never seen before. One of the most curious is the Kangaroo. It never runs on all fours, but uses its strong tail as a sort of spring, and hops on its hind legs in long leaps. The mother kangaroo carries her young in a pouch till they can look after themselves. Perhaps the most curious creature is the duck-bill. It lives in a burrow by the side of a stream, has a bill and webbed feet like a duck, lays eggs and is covered with soft fur. The emu, a bird six feet in height, has no wings but can run as fast as a horse. Black swans are seen on the lakes. The dingo, or

wild-dog, is found in no other part of the world. It is something between a jackal and a wolf. The animals brought by the settlers, such as horses, cattle and sheep, have increased greatly in number. Camels brought from India are used in the dry desert regions. The rabbit, introduced as a pet, has multiplied so rapidly that thousands of pounds are spent every year to keep down its numbers, for it eats up the sheep pastures.

CHAPTER LXIV.

AUSTRALIA (Continued).

How the People earn their Living.—The colonists who settled in Australia were Europeans—mostly natives of the British Isles. The great heat and dampness of the monsoon regions in the north do not suit them. They therefore make their homes in the cooler and drier south. What attracted them to leave their homeland and cross the ocean to the other side of the world ? They came for two reasons. In the first place, Australia is a splendid pasture country with plenty of land waiting to be ploughed. Secondly, many minerals, especially gold and silver, are found there.

Farming and Grazing.—To start with, all useful animals had to be imported. In 1788 seven horses, seven cattle and twenty-nine sheep were introduced. The land on the Pacific coast was found to be most suitable for grazing, for this side of Australia receives steady rains from the south-east trade winds. The slopes between the high land of the Great Divide and the coast are very fertile. There is plenty of forest, and large crops of wheat are grown. The whole of this large region is good pasture land. On the parts nearer the coast where the rainfall is heavier, large herds of cattle are raised. Farther inland, up the slopes and on the inland side of the Great Dividing Range millions of sheep are bred. Sheep were the beginning of Australia's prosperity and to-day the rearing of sheep is its chief industry. An Australian sheep has more than five times as much wool as an Indian sheep, and it is of much finer quality. On some farms the sheep stand

knee-deep in rich grass. Here many can be fed on a small space. In other parts they may be seen grazing on ground almost as bare as a road, but the little fodder they do get is nourishing. Here the farms are large, and the farmer has to ride for miles to visit all his flocks. Beyond the Dividing Range there is still less grass but here, luckily, certain salt shrubs grow on which sheep thrive well. Australia thus depends largely on sheep. She exports more wool and mutton

Photo. E.N.A.

Fig. 162.—In Australia. Collecting Sheep for Shearing.

than any other country. Large steamers fitted with store rooms call at Sydney, Brisbane, Melbourne and Adelaide. The carcases, after the skin and entrails have been removed, are placed in these store-rooms. Here they are frozen till they are as hard and cold as ice. In this state they are kept fresh during their long voyage to Europe. There they are thawed and sold as fresh mutton. This trade in frozen mutton is very large. The wool is cleaned, packed into bales and sent to Britain and European countries, where it is made into cloth and blankets. This wool is long and silky and is the finest in the world. From the cattle-farms barrels of

butter, cooked beef packed in tins, hides, horns and tallow are shipped to Europe. Every Australian farmer keeps horses and can ride well. Thousands are sent to India every year. The Government buys large numbers for the use of cavalry regiments, for our climate does not suit horse-breeding. They are called 'walers' which means that they come from New South Wales.

In the cooler, drier climate of the south and east, wheat, equal to the best grown in Canada, is an important crop. In famine years the Indian Government buys ship-loads of it as food for the people. Great Britain also imports large quantities. Oats are another grain crop, and they also are exported. When Australia was first settled, there was not a single fruit, native to the country, fit to eat. Fruit trees were brought from England, and now, in the cooler southern parts and in Tasmania island, there are many orchards of apples, peaches and pears. During the Great War, when sugar was very dear in England, the people of Australia made a great deal of jam and much of it came to India. This trade is now a flourishing one, for sugar cane is widely grown in the warmer parts of the country, especially in Queensland. The vine has also been introduced and thrives well in the dry ripening Mediterranean climate of the south. A good deal of Australian wine is now made and exported. It is expected that Queensland will become an important cotton-growing country. Its hot climate suits this plant.

Australia has thus attracted many people from Europe who like a country life. They have gone there to breed sheep, cattle and horses, to grow wheat, oats and fruit. But there is one great drawback to farming life in certain parts—drought. In the sheep lands away from the sea, hot, parched winds sometimes sweep across the country. The rivers dry up and often no water is to be found. The pastures wither, the parched ground is white with the bones of sheep and cattle and the farmers are ruined. Eighty lakhs of sheep have been known to die for want of water in a single year. The people and Government have fought hard against drought. They have

borrowed engineers from India to show them how our tanks and irrigation canals are made. But in Australia during droughts the rivers dry up. There is no great store of water like that in the Himalayas, where, in the hot season, the snow

FIG. 163.—An Artesian Bore in Australia.

and ice melt and fill so many rivers. Engineers have found that in many of the dry parts there are great stores of water deep underground among the beds of rock. Here holes are bored for 3000 or 4000 feet down with an instrument like a screw. As it goes down, a pipe follows. When the water is reached it rushes with great force through the pipe, and some-

times spouts high into the air. These holes are called artesian wells, and they are now made in some parts of India. The water from these wells flows all the year round. Hundreds of them have been sunk, allowing much dry land to be cultivated, and, in seasons of drought, saving the sheep and cattle from dying of thirst. Some people think that in the dry desert parts of 'the Dead Heart of Australia' underground water may some day be found in large quantities.

Mining.—Australia is very rich in minerals. In 1851 the news suddenly spread among the colonists that gold had been found at Bathurst, less than one hundred miles inland from Sydney, across the Blue Mountains. Almost at the same time gold was also discovered at Ballarat and Bendigo, less than one hundred miles inland from Melbourne. At the Kolar Gold Fields in Mysore State gold is found in hard rocks thousands of feet below the surface. Much money has to be spent before machinery can be brought to sink the deep mines, break the rock, bring it to the surface and then crush it into powder to get the grains of gold. But in Australia it was quite different. There the gold was found shining on the surface and in the beds of streams. Sometimes it was found in lumps. More often it could be got in small pieces by washing river mud in vessels and letting the heavy gold sink to the bottom. Thus it was easy to get rich quickly. At once everybody in Australia seemed to go mad with excitement. There was a rush to the places where gold had been found. The news spread to other parts of the world. Soon the harbours were crowded with ships full of people from Europe, Asia and America, who had come to seek for gold. Enormous quantities were found. Many made fortunes and the population of Australia increased by leaps and bounds. This was just what Australia needed. It brought to this distant new land what was much more precious than gold—men. After all the gold on the surface had been picked up, these people who had come, many with their wives and families, to wash the glittering sand, remained in Australia and made their home there. They became farmers, shepherds and gardeners. These people and their

children were the founders of the great Australian nation which is now growing up in this island continent.

Gold is still largely mined in Australia, which at present produces about five times as much as India. But it is no longer found on the surface. Costly and deep mines must be sunk to reach it. There are mines at Bendigo and Ballarat. At present the south-west corner of Australia, round Coolgardie and Kalgoorlie, has the richest gold-mines in Australia. At Broken Hill, in the west of New South Wales and connected with Adelaide by a railway, are wonderfully rich mines. From them tin, silver, lead and zinc has been dug up in large quantities. Rich copper mines are worked to the east of Broken Hill. At Mt. Morgan near Rockhampton in Queensland, there is a hill which has been called a mountain of gold. More copper than gold is now being taken out of it. There are small coalfields lying inland from the Pacific Coast, and one important one inland from Sydney.

Population.—Australia is the most thinly peopled of the continents. Its population is much smaller and very much less dense than that of Bombay Presidency or of Bengal. What are the reasons for this ? In the first place Australia is really a new country. Very few of the grandfathers or great-grandfathers of the people living there now were born there. They came from Europe. The original inhabitants were few, knew nothing of agriculture, possessed no milk-giving animals, and so could not produce food enough for a large population. They are now dying out. Secondly, Australia was for long unknown to the rest of the world and it is difficult to reach. Thirdly, large parts of it are desert. Nearly one half of this great continent is useless for agriculture, and is fit only for wandering shepherds. About a quarter of it receives less than ten inches of rain. In all these ways it is very different from India which, owing to good rainfall, is very densely peopled. There are more people in Bombay and in Calcutta than in any of the states except New South Wales and Victoria. The total population is only about sixty lakhs.

Density of Population.—Compare the population map with the map of rainfall. They correspond very closely; the wetter parts are the most thickly peopled. The only exception is in the wet monsoon regions in the north. Here, though there is a heavy rainfall and fertile soil, there are few

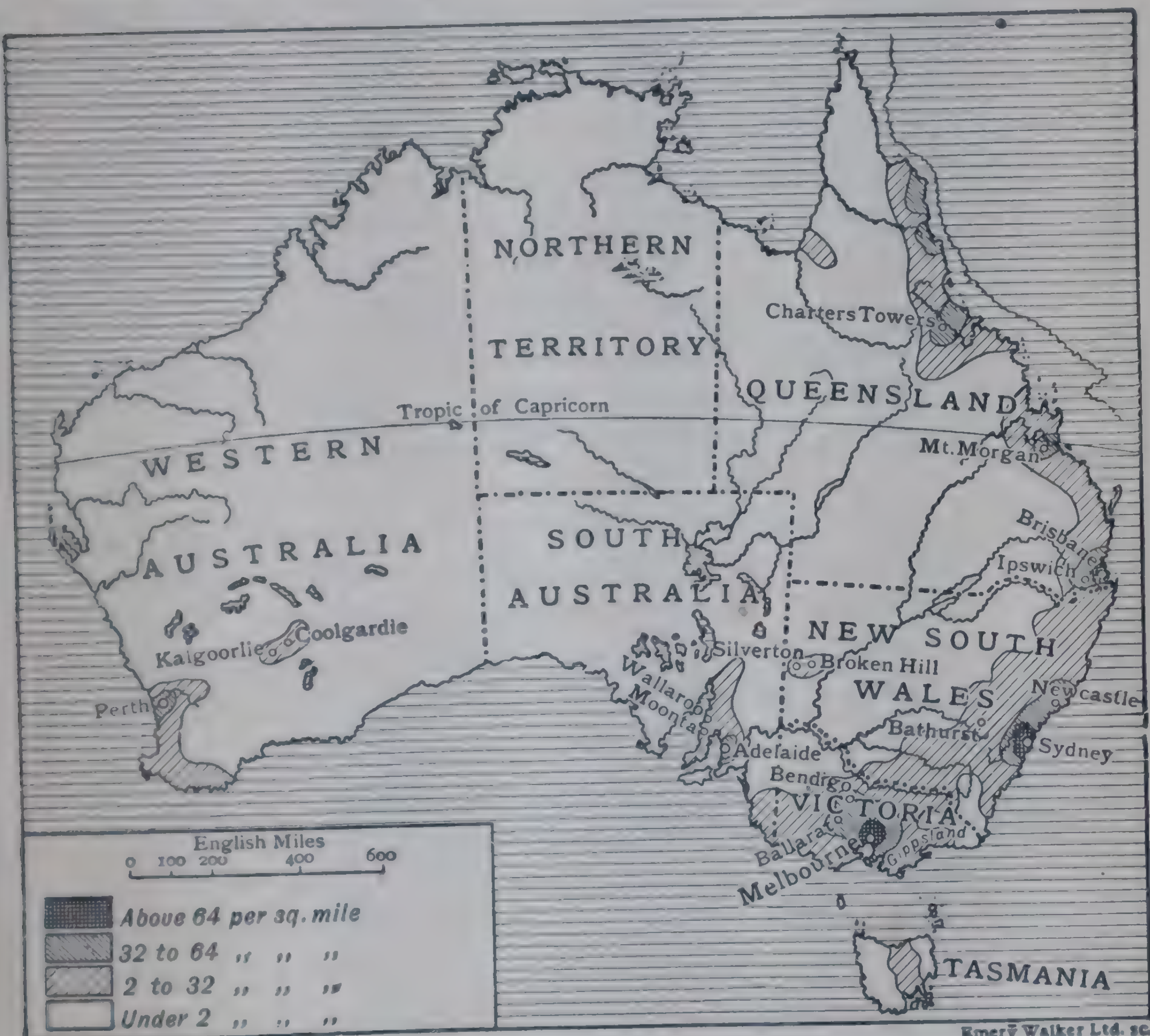

FIG. 164.—Population map of Australia (compare with rainfall map).

people. The reason is that the settlers came from countries with a temperate climate, and so they made their homes, not in these hot, damp lands, but in the cooler parts in the south. The map shows the chief area of population is the broad belt covering the eastern bulge of the continent stretching from the coast inland across the Dividing Range. It also extends into

the high-land inland from Spencer Gulf, and inland from the south-west corner. These are the cooler and more fertile parts. Population is densest in Victoria where the climate is coolest. It becomes thinner everywhere as we go inland towards the central desert. Population is also centred round the mines.

Communications.—Australia is handicapped by the want of natural waterways. There are, for its size, few inlets of the sea. The rivers of the north and east with water all the year round are navigable only for a short distance; the longer rivers of the interior are of no use for navigation except the Murray-Darling, which can be used by small steamers for only a few months of the year, and has no useful opening to the sea. The lakes, which look large on the map, are little better than marshes. The desert interior has no roads, and is impassable except for camels along a few routes. Railways have, therefore, had to be built and the progress of Australia, more than that of any other country, can be measured from time to time by studying the extension of the railway lines. These have been made where population is densest, connecting the capitals and seaports, Sydney, Melbourne, Adelaide, Brisbane and Perth, with inland farming, sheep-rearing and mining districts. It is possible to travel by rail from Adelaide through Melbourne, Sydney and Brisbane to the north of Queensland. But in the northern and western coasts there is scarcely a single line for thousands of miles. Western Australia is separated from the sister colonies by a great desert. A railway has recently been built to connect Perth and Adelaide. This line runs eastwards from Perth, climbs the table-land to Coolgardie and Kalgoorlie, and then strikes straight eastwards across the treeless plain, where not a river or drop of surface water was to be found for 1000 miles, and not a human habitation was to be seen. Passing then through swampy country, it strikes the coast at Port Augusta at the head of Spencer Gulf, where it meets the line running north from Adelaide. This railway will allow men and munitions to be carried from one part of the Commonwealth to another in case of attacks from enemies. It will also save two days in sending letters

from Europe and India to towns in the east of Australia. Another line has been begun northwards across the Central Desert to join Port Augusta with Port Darwin on the north coast. Unfortunately the railways of Australia, like those of India, are not all of the same gauge.

Manufactures.—There are at present few manufactures, and most iron, steel, cotton, woollen and leather goods are imported from Europe and Britain. But in recent years Australia has begun to make cloth from her wool, leather and boots from her hides, wine and jam from her fruit, butter from her pastures, and sugar from the cane-fields of Queensland. The chief exports come (1) from the pastures, namely wool, frozen beef and mutton, skins, hides, tallow, leather and butter; (2) from the forests, karri and jarrah; (3) from fields and gardens, wheat, oats, cotton and sugar (Queensland) and some fruit and wine; (4) from mines, gold, silver, copper, zinc, tin, lead and coal.

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CHAPTER LXV.

POLITICAL DIVISIONS.

The Commonwealth is divided into six mainland divisions, and includes also the island of Tasmania. The inland boundaries of these states are mostly artificial. The Murray River, between Victoria and New South Wales, is the only natural one. No man has ever travelled along these boundaries. Some of them run across th desert. So the states have agreed that they should be marked by lines of latitude and longitude. Thus the meridian of 141° E. forms part of the boundary of four of the states or provinces.

New South Wales is the mother colony. The Dividing Range runs through it parallel to the coast. The strip between this high-land and the sea is fertile and has many short rivers. On the inland side stretch savannah lands, watered by the Darling and other feeders of the Murray. These produce much wheat and pasture large flocks of sheep. **Sydney** is much the most important city and seaport. It is built on both sides of Port Jackson, a large land-locked and sheltered inlet where hundreds of vessels can lie at anchor. Sydney is, indeed, the most important seaport of Australia, exporting the wool, frozen mutton, wheat and horses brought to it from inland pastures. Unlike most large cities in India, it has broad streets, fine parks and gardens, for, when the town was first planned, ground was cheap. **Newcastle**, on the Hunter River a little to the north, is the chief coal-mining centre in Australia. Sydney exports this coal, and is the principal coaling station of the continent. This alone would make it an important seaport. Some of it comes to India.

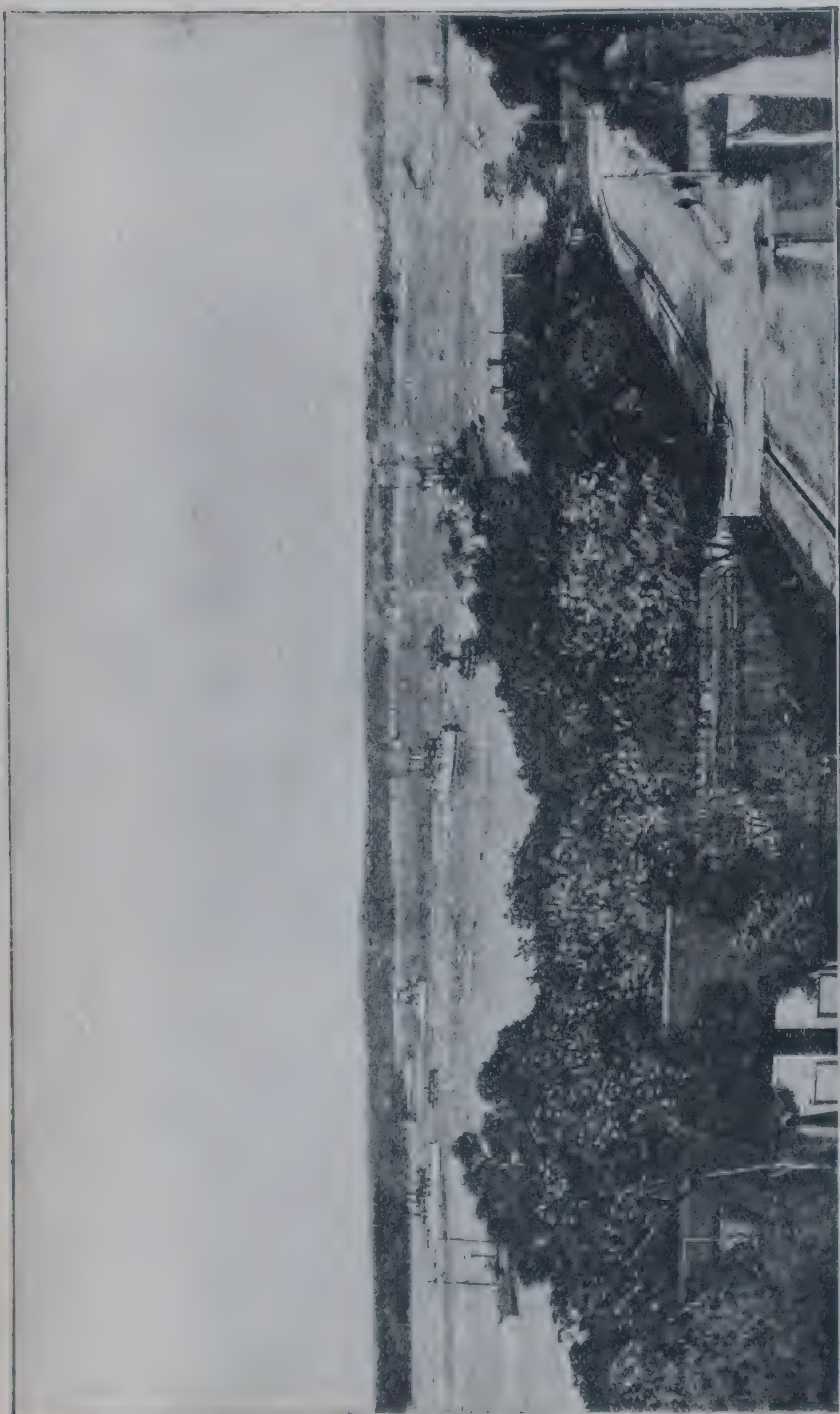


FIG. 165.—Part of the fine harbour of Sydney, showing warships.

Victoria takes up the south-east corner south of the Murray River. The Australian Alps here form the highest part of the Dividing Range, and run east and west. Their slopes are covered with fine timber trees. The province grows wheat, oats, grapes and fruit, and rears large flocks of sheep, herds of cattle and mobs of horses. **Melbourne**, the largest city in Australia, stands close to the head of Port Phillip inlet, and this makes it one of the chief seaports. But it is but a baby in age compared with towns such as Delhi, Benares or Madura. Men are still living who remember when the site of the town was a mud-swamp with a few rough wooden huts. Now it is a great city with splendid buildings. Though it has a smaller population than Calcutta, it takes up far more space. Like Sydney, it exports the products of fields and pastures. **Bendigo** and **Ballarat** are mining towns to the north.

Queensland takes up the north-east quarter of the continent. Here we are nearer the equator and the climate is hotter. The part furthest north is a monsoon country, where the crops and fruits of India can be grown. Wheat, sugar-cane, cotton and plantains are widely cultivated. Millions of sheep graze on both slopes of the Dividing Range, here called the Darling Downs. The chief town and seaport is **Brisbane**, twenty miles up its river. Like the Hughli it must be dredged to keep a deep fairway open for vessels. In its harbour lie ships waiting for cargoes of wheat, wool, mutton, beef and butter. A good map shows other seaports to the north. They export the same produce as Brisbane.

South Australia takes up the central part of the continent in the south. The northern part of it stretches into the Central Desert. Here there are no real rivers and no towns. The only really fertile region is the small strip of country running inland from Adelaide, across the Murray River. On it wheat and oats, grapes and other fruits are grown, and large flocks and herds are reared. From **Adelaide**, the chief town, lines run inland for some distance, and it is also the starting place of the overland telegraph line which crosses the continent from south to north to its other end at Port Darwin. Here it

is joined to the under-sea wires which go to Singapore, and Madras. The harbour of Adelaide is Port Adelaide, close to the city.

Western Australia takes up nearly one-third of the continent. Only in the south-west corner and on the monsoon coast, in the far north of the province, is there a good rainfall. At present only the south-west corner is of much importance; the rest is but thinly peopled, and large parts of the great desert table-land inland are still unknown. This south-west corner has a temperate climate, and it lies in the track of the westerly winds of the cold season. Wheat farms, pasture farms, orchards and vineyards are seen everywhere. The good rainfall also produces fine hard-timber forests of karri and jarrah. Going inland we soon come to dry uplands, then poor scrub and then pure desert.

Perth, the chief town, on the Swan River has a good artificial harbour at Fremantle. The best harbour is **Albany,** a coaling station connected by rail with Perth. **Coolgardie** and **Kalgoorlie,** two mining centres, lie inland.

The Northern Territory of Australia.—This large area, nearly as large as one-third of the Indian Empire, is under the control of the Commonwealth. It has many fine rivers, fed by monsoon rains, and several good harbours, of which **Palmerston** or Port Darwin is the chief. Behind the low coast rises the table-land, most of which is dry and sandy. There are very few inhabitants in this vast area—less than that of a small town.

Tasmania.—A fast steamer sailing from Melbourne across Bass Strait can reach this island in a day. It is the smallest of the Commonwealth states, and is only a little larger than Ceylon. The centre is a table-land with mountains and valleys. The island receives plenty of rain from the wet west winds, and forests cover large parts of the country. The climate is cooler than that of Australia and very like that of England. **Launceston**, on the north coast, and **Hobart**, with a fine harbour, on the south, are the chief towns and seaports. A day's railway journey takes us from one to the other. The

island grows wheat and oats. Its chief export is apples which are shipped to England, and arrive there in the winter when no fruit can be grown.

The geography of Australia is unlike that of other continents. It is really the story of how Europeans, chiefly Englishmen, landed on its unknown shores, explored its forests, its rivers, its swamps and deserts, began to till the soil and breed the sheep, cattle and horses which they brought with them, of how gold was found, and how thousands of people from Europe flocked to the new and distant land and made their homes there, till now Australia is the homeland of a new nation forming part of the British Empire. Every one has heard how bravely Australian troops fought for the freedom of that Empire against the Germans in the Great War. The original inhabitants, who are one of the rudest and most backward of peoples in the world, are dying out. If they are taught and civilised, they die off more quickly than if they are left alone. There are fewer of them than the inhabitants of Bombay city.

New Guinea or **Papua.**—The western half of this lizard-shaped island belongs to the Dutch. The eastern half was, before the war, divided between the British and German empires. The German Empire has now disappeared, and the whole of the eastern half, together with some islands off the coast, is now part of the Empire and placed under control of the Australian Commonwealth. Coco-nuts, plantains and sugar-cane are grown, and some sandal-wood, rubber and copra are exported. Steamers ply between **Port Moresby,** the chief port, and Sydney. In the interior are mountains high enough to be snow-covered though so near the equator.

CHAPTER LXVI.

THE DOMINION OF NEW ZEALAND.

Map Study.—From the map we see New Zealand is made up of the North and South Islands, separated by the narrow Cook Strait (called after the famous discoverer), and the much smaller Stewart Island, in the south. To reach it from Australia, we can sail from Hobart in Tasmania to Invercargill, a harbour at the south end of South Island. Or, we may start from Sydney and land at Auckland, a seaport on the neck of the flat peninsula of North Island. The voyage in either case is about 1200 miles, or about the distance between Madras and Rangoon. But though we have not to travel far, we come to quite a different land, and we can easily learn the geography of New Zealand by contrasting it with that of Australia.

Size and Shape.—Australia is really a huge continent with but few inlets of the sea. How different is New Zealand! Firstly, it is very much smaller—smaller than Queensland or New South Wales. Secondly, it is a group of islands. Zealand means sea-land, and this name was given to it by its Dutch discoverers. The coast is broken by many inlets, and no part is far from salt water. The south-west coast is much broken and fringed with islands like those of Norway and south Chile. These openings pierce the mountains for miles, and are therefore enclosed by high cliffs. But here we find no good harbours for high rocky mountains rise behind. The long north-western peninsula of North Island is also much broken, but it is flat. A narrow isthmus joins it to the mainland. This is a suitable place for a harbour and here stands the most important


170°
174°
178°
36°
40°
44°
PACIFIC
OCEAN
NORTH ISLAND
Auckland
Bay of Plenty
Mt. Egmont
Hawke Bay
Napier
Cook Strait
Wellington
Nelson
Westport
SOUTH ISLAND
Southern Alps
Mt. Cook
Canterbury Plains
Christchurch
Lyttelton
Banks Peninsula
PACIFIC
OCEAN
Port Chalmers
Dunedin
Invercargill
Stewart I.
NEW ZEALAND
English Miles
0 50 100 200
Principal Railways
166°
170°
Longitude East 174° of Greenwich
178°

FIG. 166.

seaport of the country. In shape New Zealand is something like a man's leg broken in two—not unlike Italy turned upside down.

Build.—This, too, is quite unlike that of Australia. There, the high land runs close to the coast. Here, it runs nearly in a straight line along the axis of the two islands from south-

FIG. 167.—Tasman Glacier, New Zealand.

west to north-east. In South Island these ranges are high and come close to the west coast. They are called the Southern Alps, for, like the Alps of Europe, their highest peaks are covered with snow, and there are glaciers in the valleys, and snow-fed lakes in the hollows. In North Island there are three or four volcanoes much higher than our Western Ghats. Two of them are still active, and near them earthquakes sometimes take place. Large parts are covered with ashes and broken pieces of old melted rock. Lake Taupo lies in this

region. North-east of it are some small lakes of hot water. Clouds of steam rise from cracks in the rocks and the air is full of sulphurous vapour. In some places columns of boiling water shoot high into the air. The hot water of these lakes and springs being filled with sulphur, people suffering from rheumatism and skin diseases come to bathe in it.

Climate.—New Zealand differs from Australia in its climate also. It is cooler because it is farther from the equator, and because no part is far from the sea. It has an equable climate. No part of it is so near the equator as is the northmost part of India, so its climate is much cooler than ours, but it is warmer than that of the British Isles. Its cool season is, of course, our hot season.

The rainfall is also different from that of Australia. Much of Australia is very dry and there are large deserts. In New Zealand there are none. The rainfall maps show that only a small part of Australia receives more than 20 in. of rain, while nearly the whole of New Zealand gets more. There we can travel for a thousand miles without seeing a river ; here, there are rivers everywhere. This is a sign that these islands receive much rain. Only the most southerly parts of Australia are in the path of the westerly winds, and that only during the cold season. But New Zealand, being farther south, receives these rain-bearing winds all the year round. The air is damp and plants grow easily. Most rain falls on the western coast facing these winds, and here, on the edge of the Southern Alps, there is as heavy a rainfall as on the Western Ghats. Besides, on small islands like these, every wind is a wind from the sea, and brings moisture.

Rivers.—As the mountains run lengthwise along the islands, they form a long watershed and send rivers to the sea on either side. There is not space for long rivers. The Indus is longer than the whole length of the islands. Owing to the good rainfall the rivers never dry up, but they are too short and rapid to be of much use for navigation.

Vegetation.—New Zealand is thus a very green country. Everywhere the land is covered with plants of some kind.

There is no hot dry season as in India. When Europeans first settled here, more than half of the country was covered with dense forest and jungle. In North Island there are forests of the kauri pine which grows as high as 200 ft. Its timber is valuable, and from its gum varnish is made. Nearly one-third

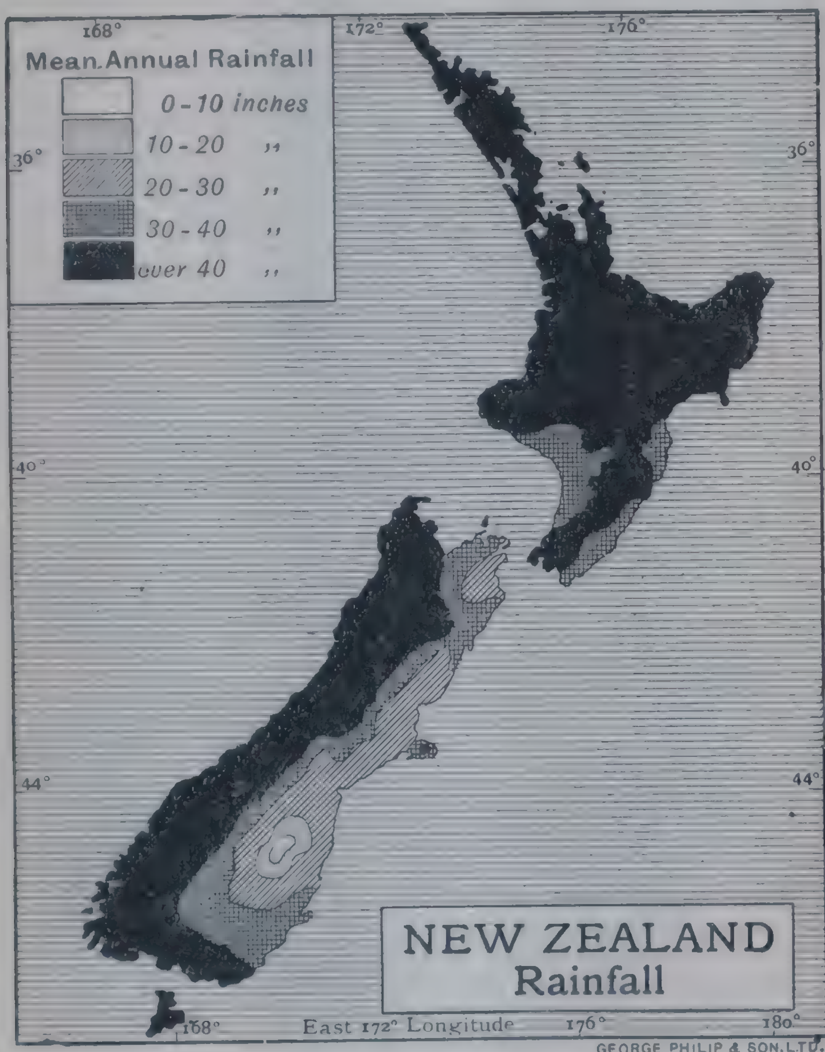


FIG. 168.

of the country is still covered with forests. The saw-milling industry is therefore important. The whole surface, except the high mountains, is suitable for agriculture and pasturing; there are no deserts. Most of the farmers graze sheep and cattle, and wool is one of the chief productions. As in Australia, frozen mutton and beef are shipped to Europe. New Zealand,

like Canada, sends shiploads of butter and cheese to Great Britain. Where the land has been cleared and ploughed, good crops of wheat, barley and oats are reaped. It is too cold for rice. When the first colonists came they found no food-giving plants nor any animals they could tame.

New Zealand has gold and coal mines and there are some oil wells. Near the volcanoes sulphur is obtained.

Population and Towns.—The people are mostly settlers who, or whose fathers, have emigrated from Europe, chiefly from Great Britain. In a young country, where most of the inhabitants live by farming and grazing cattle and sheep, we do not expect to find a dense population or many towns. Bombay city has more than half as many inhabitants as the whole of New Zealand. All the chief towns are built round harbours. There were no towns at all before the colonists came. They chose places where ships from Britain and Europe could find shelter when they brought their cargoes. These places, by the help of this trade, have grown into towns. There are only four or five with more than half a lakh of inhabitants, but, owing to their position and trade, they are more important than towns in India of the same size.

Auckland, on the shore of a fine bay on the east coast of the long peninsula of North Island, and only six miles from another harbour on the other side of the isthmus, is the chief seaport. **Wellington**, on a fine sheltered inlet of Cook Strait, has a splendid harbour. Owing to its central position it was chosen as the capital, and here the Dominion Parliament meets. **Christchurch** lies near the east coast of South Island, and depends for its trade on the wool and meat produced on the grassy Canterbury Plains which stretch inland to the foot of the mountains. Its port is Lyttelton. **Dunedin**, at the head of a narrow inlet, is the market and sea outlet of the mountainous districts behind it. **Invercargill**, in the extreme south, is a port of call for steamers. Railways along the coast join the seaports. New Zealand has not joined the Commonwealth of Australia—she is too far away. She has a Parliament of her own under a Governor or Viceroy. Under

this government are several groups of outlying tropical islands which can be seen marked on a good map. **The Cook Islands** form one of these groups. The New Zealand troops were among the bravest fighters for the Empire in the Great War.

The Maoris.—The original inhabitants of New Zealand are quite different from those of Australia. When Captain Cook

FIG. 169.—A Maori.

first visited these islands he found the Maoris to be a tall brown-skinned race of fighters and cannibals always at war with one another. They have now been civilized and educated, and some of them are members of the New Zealand Parliament. Many of them fought alongside the New Zealand troops in France in the war. They live in villages near the volcanic parts of North Island.

ISLANDS OF THE PACIFIC OCEAN.

A map of the world shows several groups of islands scattered in the Pacific to the north-east of Australia and New Zealand. Unlike most of the other islands of the world they have never formed part of a mainland, but have been built up from the ocean floor by coral polyps or raised up as volcanoes. They have

FIG. 170.—An Island in the Hot Belt of the Pacific Ocean.

very few plants or animals of their own—only such birds and insects as can fly across the ocean, or animals such as mice and rats which may drift across to them on floating logs. The people living on them must have reached them long ago on rafts and boats. The map shows that they lie in the Tropics on both sides of the equator. The climate is, therefore, hot and damp but very equable. The vegetation is much the same as that of Ceylon—coco-nuts, plantains and bread-fruit are the chief food-giving plants. The islanders live chiefly on fish. On some of the larger islands crops of maize, rice, cotton and

sugar-cane have been introduced by Europeans. Most of these islands belong to the Empire. Of these the **Fiji, Friendly** and **Society** groups are best known. The most important group is the Hawaii or **Sandwich Islands,** under control of the United States, close to the tropic of Cancer. The capital, **Honolulu,** has a good harbour, and from its central position in the Pacific it is the meeting-place of steamship routes from Yokohama, Hong Kong, Sydney and Auckland on the one side, and Valparaiso, the Panama Canal, San Francisco and Vancouver on the other. These Pacific Islands are often called Polynesia—a word meaning Many Islands. They can be seen marked on the coloured map of Trade Routes.

CHAPTER LXVII.

THE CONTINENTS OF THE NEW WORLD.

(See coloured maps.)

THE New World is made up of the two continents of **North** and **South America**. They lie on the opposite side of the globe from India. Across the middle of the Indian Empire passes the meridian of 80° E., and through the middle of North America passes the meridian of 100° W., so that half the surface of the globe lies between them. To reach these continents from Asia, we should have to take a long voyage across the broad Pacific; to reach them from Europe or Africa, the voyage across the Atlantic is much shorter. This large part of our world was quite unknown to the people of Europe 450 years ago. Since 1492, when it was discovered by Columbus, thousands of people from Europe, many from Africa, and a few from Asia have crossed the ocean and made this New World their home. Spaniards and Portuguese conquered and settled in Central and South America. North America was colonised by people from North Europe—chiefly Englishmen, Frenchmen and Germans. Those who came from Africa were imported negro slaves.

Map Study.—Shape and Build.—The two continents are somewhat alike in shape. Each has its broadest side facing north and each tapers to a point in the south. North America has the more broken coast-line; South America has few arms of the sea entering the land. In Asia the high land stretches, roughly, east and west; in the Americas it stretches north and south. Mountain ranges run, like a backbone, along the western or Pacific coast through both continents—the Rocky Mountains in North America and

FIG. 171.—A large Ocean Steamer.

the Andes in South America. Thus the most important rivers flow into the Atlantic. The map also shows high lands close to the Atlantic border. They are not nearly so high nor so continuous as the mountains in the west. They are rather table-lands like the Deccan which have valleys running across them formed by rivers. In both continents, between the mountainous high land on the west and the lower table-lands on the east, there stretch immense plains. These have been formed and are drained by long rivers, and contain some of the most fertile soil in the world. The large rivers of the two continents match each other. The St. Lawrence corresponds to the Amazon, the Mississippi to the Paraguay-Parana which enters the Plate estuary. We may compare the Mackenzie with the Magdalena.

NORTH AMERICA.

Map Studies.—The Chief Features of the Coast.—In the north the large Hudson Bay is connected both with the cold Arctic Ocean in the north and the Atlantic in the east. On the east lies the Gulf of St. Lawrence, partly blocked by islands and separated from Hudson Bay by the broad bleak peninsula of Labrador. In the south is the large round Gulf of Mexico, protected by the two jaw-like peninsulas of Florida and Yucatan. Out of these jaws stretches a long tongue of islands, the tip of which seems to touch the coast of South America. The coasts of the Arctic Ocean are much broken. The large island of Greenland is covered with a thick sheet of ice which is always slipping into the sea. Huge lumps of it, called icebergs, break off and float away. The other Arctic islands, being covered with ice and snow for many months, are also useless to man. The northern half of the west coast is fringed with islands, separated from the mainland by deep narrow arms of the sea—very suitable for sheltered harbours. The largest island is Vancouver. The southern half is marked by the long narrow peninsula of California, separated from the mainland by the long gulf of the same name.

How the coasts were formed.—The map of North America shows us how changes in the level of the land have made the coasts in some places very suitable for man's use. Thus, the north-eastern shores are very broken. The reason is that this part has been lowered several feet. The ocean has filled up old valleys of the land while the higher parts remain above water as peninsulas, islands and capes. This sinking of the land has thus made many sheltered creeks and bays well suited for harbours. A steamer off the coast of India has no shelter to which she can run (except behind the island of Bombay). It is very different on the coasts of Canada. The peninsulas of Labrador and Nova Scotia and the island of Newfoundland and hundreds of others were formed by this sinking of the coast. So were the bays on the east coast on which are the fine harbours of Boston, New York, Philadelphia and Baltimore. Part of the Pacific coast has also sunk and formed creeks and islands. On the sound which separates Vancouver Island from the mainland are several important harbours. The splendidly sheltered harbour of San Francisco is just a hollow into which the sea flowed when the coast sank. But, though these coasts have sunk, they have not sunk very deep—only a few hundred feet—and this shallow sea is therefore a splendid fishing ground. Off the broken coasts on the western and especially the eastern shores of Canada large quantities of fish are caught and there are many fishing villages.

On the other hand, the southern coasts, *e.g.* those of the Gulf of Mexico, have not sunk but risen. The old bed of the sea, *i.e.* the level platform or shelf made by the mud spread over it by rivers, has been raised and now forms a low level plain with no deep inlets. If the flat bottom of the sea round the coasts of India were to be raised, our few harbours would disappear and there would remain a low smooth shore with no suitable openings for seaports.

Build.—**1. The Western High Land** stretches the whole length of the continent. It is broadest in the middle and narrower in the north and south, and comes so close to the west coast

that only a narrow low strip is left between it and the Pacific Ocean. The Rocky Mountains are the highest part of this western high land, and they run north and south about the middle of it. To the west of them lie other ranges. In the north these are called the Cascades; farther south they are known as the Sierra Nevada (Snow Mountains). Between these outer ranges and the Rocky Mountains are wide high table-lands. Farther south the western high land forms the high table-land of Mexico flanked on either side by the Western and Eastern Sierra Madre Mountains, just as our Deccan is flanked by the Western and Eastern Ghats. Though this western high land is broadest in the middle, it is highest in the north and south. Away far in the north are many lofty peaks of which Mount McKinley is nearly four miles high and only a mile lower than the highest of the Himalayas. Far in the south, at the end of the Mexican table-land, rise Orizaba and Popocatepetl, lofty volcanoes.

2. The Eastern High Land.—This high land is much narrower and lower than the western high land and the ranges are only about the same height as the Western Ghats. This eastern high land is broken into two by the St. Lawrence river and estuary. South of this river it stretches parallel to the coast and is here called the Appalachian high land, the main range of which is the Alleghany Mountains. On the Atlantic coast there is a broad coast-strip between the high land and the sea. When colonists and settlers first came across from Britain and Europe, they lived on this coast and were for long prevented by the eastern high land from spreading westwards into the heart of the continent. A part of this coast is called New England.

3. The Central Low Land.—This lies between the western and eastern high lands. In the north it slopes gently down to Hudson Bay and the Arctic Ocean, where it is broken up into many low-lying islands. In the south this low land borders the Gulf of Mexico.

Rivers.—The rivers flowing into the Pacific are not nearly so important as those flowing into the Atlantic. The map

shows us the reason. They have to flow from the steep western high land across a narrow coast strip and are therefore of little use for navigation. Some of them have to cut their way over the table-land and between mountains in narrow valleys and deep gorges. **The Fraser River** enters behind Vancouver Island. One of its gorges is so deep and narrow that the rays of the sun never reach it. Its valley is, however, used by the Canadian Pacific Railway to reach Vancouver city at its mouth. **The Columbia and its feeder, the Snake**, like the Upper Indus, wind through narrow valleys. **The Colorado**, which enters the head of the Gulf of California, flows through deep gorges which the Spaniards called canyons. One of these canyons is over 200 miles long and its walls of rock are in some places a mile high. Far in the north is another Pacific river—**the Yukon**. It is one of the longest rivers on the continent, but, being so far north, it is frozen for most of the year. Now look at the rivers flowing into the Atlantic from the eastern high land. There are several of them, but they are not very long. The most important are **the Hudson, Delaware, Susquehanna,** and **Potomac.** Why are they important? Their valleys offered a fairly easy route across the eastern table-land to the fertile central plain. Roads and railways have been made along their valleys. We might compare these openings with the Palghat Gap.

But, as yet, we have only learned some of the smaller rivers. We should expect the large rivers to drain the wide central plain, and the map shows that they do so. These rivers make North America the best watered continent on the globe. Trace **the Mackenzie** flowing north into the Arctic Ocean. It is fed by many lakes lying in hollows of the low land. Great Bear Lake and Great Slave Lake are the two largest. Like the north-flowing rivers of Siberia, the Mackenzie is, however, of little use, for both the river and its lakes are frozen for many months of the year. In the north part of the central plain lies Lake Winnipeg into which other lakes and some rivers drain. One of them is **the Red River** flowing northwards along a very fertile valley.

This lake is joined to Hudson Bay by **the Nelson**, which may some day become a water-gate from the sea to this part of Canada. The difficulty is that it, too, is frozen for part of the year.

The next great drainage area is that of **the St. Lawrence**. Lakes Superior, Michigan, Huron, Erie, and Ontario are the gathering places for the water of this river, and they are the most important lakes in the world with many busy ports on their shores. When the St. Lawrence leaves Lake Erie on its way to Lake Ontario, it is called the Niagara. At first it flows gently over a broad level channel. But after a few miles rapids are formed in which no boat can live. Just below the rapids the clear green water of the great river leaps over a precipice 160 feet high. These are the famous **Niagara Falls** which are visited every year by thousands of sight-seers. After leaving its last lake the St. Lawrence is a fine broad stream. It has still 600 miles to go to the sea and forms one of the most important waterways in the world. By the help of deep ship-canals dug to join points above and below rapids and falls (*e.g.* the Welland Canal which avoids the Niagara Falls and joins Lakes Erie and Ontario), even large vessels can steam up the river and through the lakes to the far end of Lake Superior.

The broad basin of **the Mississippi** takes up the southern part of the Central Plain. This river, which is much the largest in North America, drains both the western high land on its right bank and the eastern high land on its left bank. Rising in a small lake not far from Lake Superior, it flows southward through the middle of the Central Plain to the Gulf of Mexico. Near St. Louis, half-way down its course, it is joined by **the Missouri**, a larger river than itself, which has come for some 3000 miles (as long as from Kashmir to Cape Comorin) from the western high land. Farther down, at the city of Cairo, **the Ohio**, the chief left bank feeder, joins it, draining the slopes of the Alleghany Mountains. We might compare the Missouri and Mississippi and their feeders with the Jumna and Ganges and their feeders, and the Rocky Mountains

with the Himalayas. When nearly 300 miles from its mouth, the Mississippi, like the Ganges, begins to split up into branches which form its delta. Here, for hundreds of miles along its banks, bunds have been built to keep the river in its proper channel. New Orleans stands nearly one hundred miles up from the mouth. This city is the main sea-outlet for the wide and fertile valley of the river and its feeders.

CHAPTER LXVIII.

CLIMATE, VEGETATION, ANIMALS AND PEOPLE.

The Climate.—(1) The continent stretches from near the north pole to near the equator : some parts are high and others are low. Thus it has different climates in different parts, just as Asia has, and for the same reasons. Its plants, crops, and animals also differ from place to place. Over a great part of the north the winter lasts from three to six months. In January water freezes over the northern half of the continent. In summer, however, all of it, except the far north and the high mountains, is warm. Most of North America has cold winters and warm summers. In the northern part of the continent the westerly winds blow on to the land bringing rain-clouds from the Pacific. Good rain falls for most of the year on that part of the Pacific coast which lies north of about 38° N. In this rainy belt the largest trees are found growing on the mountain slopes—just as in India and Burma the best teak trees grow on the coasts and hills facing the wet monsoon winds. Inland from the Gulf of California, however, only a little rain falls, as here the north-east trades blow from the land and they are therefore almost rainless. Here dry lands stretch inland from the coast and here we find the desert of Colorado, the dry basins round Salt Lake in the Rocky Mountains, and the dry table-land of northern Mexico. Between these two belts there is a middle belt between about 38° N. and about 35° N. When the heat belt is north of the equator (in our hot season), this middle belt gets little rain, and the fields and orchards must be irrigated. In our cold season this belt gets rain, for the heat belt is now south of the

equator. In short, this middle belt has a Mediterranean climate with hot dry summers and rainy winters. As in other parts of the world, this climate favours the growth of fruits

FIG. 172.

which can be perfectly ripened (and dried after being plucked) in the warm summer. In this part of America, north and south of San Francisco, large crops of oranges, lemons, peaches and

grapes are grown. Californian fruit is sent packed in tins, or dried, to all parts of America and to Europe. A good deal now comes to India.

(2) **The direction of mountain ranges** has also a great effect on climate. There is one great difference between the build of Eurasia and America. In Asia the mountain ranges run east and west: in North America they run north and south. Thus the warm south winds blowing from the Gulf of Mexico easily bring rain and heat a great distance, even far into the northern part of the continent. In consequence the Mississippi valley, unlike Tibet or Persia in the same latitude, is full of rivers and is one of the finest farming and grazing regions of the world. On the other hand, you may say, there are no mountains to stop the cold north winds. That is true. Sometimes these winds sweep down this central plain, and do a great deal of damage by checking the growth of plants. Even close to the coast of the Gulf of Mexico, in Florida, these cold winds sometimes kill the orange trees. Near the mouth of the Mississippi these winds in some years lower the temperature of the air so much that parts of the river are frozen. Now, the mouth of this river is about the same latitude as Patna. What would the people of Patna or Cawnpur think if they saw a sheet of ice on the Ganges? If they have learned the laws of climate, they know this can never happen so long as the great wall of the Himalayas is there to protect them from cold winds.

Again, the great high land of North America, full of high ranges such as the Rocky Mountains, shuts off the moisture coming from the Pacific and thus makes a large part of the interior of the United States too dry for agriculture without irrigation. The most of that country lying west of 100° W. (except of course the Pacific coast strip) is thus too dry for good crops to be grown. It is treeless but covered with grass, and here we find the great grazing lands where large herds of cattle are reared on ranches.

(3) **Sea Currents.**—The climate is also much affected by sea currents. The warm Kuro Siwo or Japan current, or

drift, helped by the westerly winds, strikes the western coast of Canada. This part of the coast is therefore warmed by heat coming from the Pacific and the ports are never blocked with ice. On the Atlantic coast of Canada it is different. The cold Labrador current flowing south from the Arctic and carrying icebergs, blocks the harbours in winter and cools the air in summer. The warm Gulf Stream, rushing out between the Florida peninsula and the island of Cuba, creeps along the Atlantic coast of the United States before turning eastwards towards Europe.

The Vegetation.—This corresponds roughly with that of Asia. The coasts and islands in the far north are very cold. The ground is always frozen. During a few weeks in summer it thaws out for only a foot or two below the surface. But no trees can grow, for their roots cannot pierce the frozen ground beneath the surface. A few plants find root but only rise an inch or two above the ground. Only in this way can they escape the cold blasts of winter and shelter under a covering of snow. These far northern Barren Lands are the same as the Tundra of Asia. As we come south, trees begin to appear, stunted at first, but still farther south they form great forests of pines and firs, just as we saw in the forest belt of Asia. Such forests form a broad belt across northern Canada from the Atlantic to the Pacific. South of this cone-bearing forest we reach grass lands and steppes just as we did in Asia. In America they are called prairies. These prairies are almost treeless. Large parts have been ploughed into wheat fields. On the table-lands inland from the Gulf of California so little rain falls that only those plants with prickly leaves and thick roots, like the cactus, can live. These are the desert and steppe regions of the continent.

Crops.—The grass-lands have now been ploughed or used as pasture. Wheat grows as far south as half-way down the Mississippi valley. It is the chief crop of Canada. Millions of acres are sown with it round Lake Winnipeg. Oats are also a large crop. South of the wheat belt we come to the warmer maize lands. This plant is a natiye of America. It is grown

most widely in the country lying between the Great Lakes and the Gulf of Mexico. Still farther south, on the warmer damper lands round the Gulf of Mexico, is the great cotton area. Here

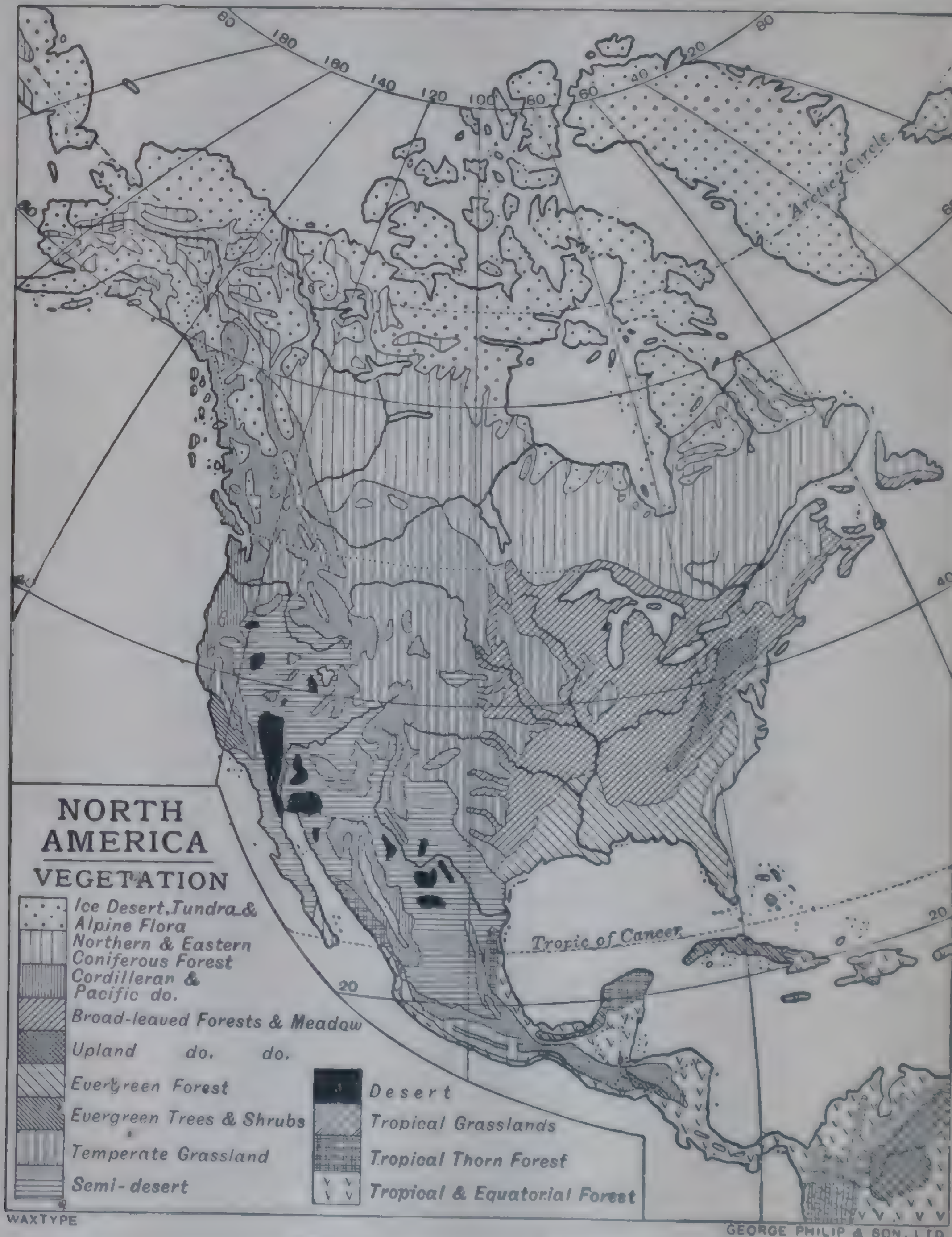


FIG. 173.—Natural Vegetation.

most of the cotton used in the world is grown. The warm parts also yield crops of sugar and tobacco. The delta lands of the great river and the island of Cuba produce most of the


ARCTIC OCEAN
ASIA
GREENLAND
Parry Is.
Banks Strait
Lancaster Sound
Baffin Bay
Baffin Land
Davis Strait
Hudson Str.
Hudson Bay
Labrador Peninsula
NEWFOUNDLAND
St. Johns
G of St Lawrence
NOVA SCOTIA
Halifax
Quebec
Montreal
DOMINION OF CANADA
Gt Bear L.
Gt Slave L
Mackenzie R
Yukon R
Nelson R
L Winnipeg
Edmonton
Calgary
Victoria
Queen Charlotte Is
Prince Rupert
Vancouver I
OCEAN
160°
140°
120°
100°
40°
20°


NORTH AMERICA
English Miles
0
500
1000
Principal Railways
120°
110°
Longitude West 100° of Greenwich
90°
80°
Emery Walker Ltd. sc.
Los Angeles
Kansas City
St. Louis
Cairo
Cincinnati
Charleston
Birmingham
New Orleans
Mouths of the Mississippi
Florida
Bahamas
West Indies
Bermudas
GULF OF MEXICO
Havana
CUBA
Haiti
Jamaica
Kingston
CARIBBEAN SEA
Tampico
Orizaba
Vera Cruz
Mexico
Popocatepetl
Acapulco
Isthmus of Tehuantepec
Belize
BR. HONDURAS
HONDURAS
NICARAGUA
SALVADOR
CENTRAL AMERICA
COSTA RICA
Colon
Isthmus of Panama
Panama
SOUTH AMERICA
Peninsula of Lower California
Gulf of California
Tropic of Cancer
OCEAN

FIG. 174.

sugar. The Mississippi valley grows the largest crops of tobacco. Most of the tobacco smoked in pipes is grown in North America.

Animals.—In the far north few animals can live. The reindeer, or caribou, and the Arctic hare feed on the moss which is almost the only plant that can grow in these parts. The white polar bear lives by fishing. Most of the animals of this cold region live in the sea, because the water is warmer than the land. Whales, walruses and seals (on which the Eskimos and the polar bear live) are the commonest. In winter, when the surface freezes, the land animals migrate southwards. Sea-birds breed in hundreds of thousands in the summer, but fly south when winter comes. In the broad forest belt are many animals which are hunted for their furs, such as bears, foxes and squirrels. Beavers, a kind of water squirrel with webbed feet and a broad flat tail used as a rudder in swimming, live on the banks of rivers in the north. Their houses are underground, and the entrance is always under water. To make the water deep to cover these entrances they cut down the stems and branches of trees with their sharp teeth and build long dams of these branches, mud and stones across rivers. Beavers are becoming scarcer as they are hunted for their fine fur. In the western high land grizzly bears, deer and elk are hunted. The herds of bison which formerly roamed over the prairies are now gone. In the warm parts far south there are many animals like those we have in India, such as monkeys, a kind of leopard called the jaguar, millions of brightly coloured birds, alligators, snakes, lizards, scorpions and numberless kinds of insects.

In the temperate parts of North America, where the forests have been cleared and the prairies ploughed, the wild animals have almost all disappeared. In place of them the settlers introduced and bred domestic animals. On every farm are cattle, sheep, horses, pigs and poultry. On the drier inland slopes of the rocky mountains, where the rainfall is rather scanty for cultivation, there are many large cattle-farms called ranches.

People.—America was inhabited for thousands of years before it was visited by European settlers. To the people of the West Indies Columbus gave the name of Indians, because he believed he had reached India. They are really of quite a different race from the people of India. The European settlers on the mainland called them Red Indians on account of their coppery brown skins. Those in the far north living on meat and flesh are Eskimos. The Red Indians were true savages, but many were half-civilised. They grew maize, or Indian corn, and tobacco (before these plants were known in Europe or Asia), baked pottery, used stone weapons, and lived in villages of huts made of skins. The women cultivated the crops while the men hunted the bison on the prairies, the bears in the forests or fished on the rivers and lakes. In the table-land of Mexico the Indians were much more civilized. They were not wanderers but farmers, and knew how to irrigate their crops. The Red Indians were splendid hunters and brave fighters, but they could not resist the European incomers. One reason was they were always at war with one another. Now, in spite of attempts to educate and civilize them, they have almost disappeared, and their place has been taken by immigrants from the British Isles, Germany, France, Sweden, Italy and Russia. In the Canadian province of Quebec most of the people speak French and are of French stock. In the southern states and the islands of the West Indies there are millions of negroes, the descendants of slaves brought over from Africa to work in the cotton, tobacco and sugar plantations. The immigrants from Europe during the last hundred years have chiefly settled in the United States. That country has been the world's greatest experiment in nation-making.

CHAPTER LXIX.

THE PARTS OF NORTH AMERICA THAT ARE INCLUDED IN THE EMPIRE.

Map Study.—The whole north of the continent except the ice-covered island of Greenland (belonging to Denmark), and the cold peninsula of Alaska (belonging to the United States), is part of our Empire. The Dominion of Canada comprises the whole of this vast territory, except the island of Newfoundland together with the coast of Labrador which has a separate government. At present we study Canada and Newfoundland together.

Boundaries.—The northern boundary is the Arctic Ocean except in the far north-west where the meridian of 141° W. cuts off the Alaska Peninsula. On the south lies the United States. The map shows the boundary on this side is partly natural and partly artificial. From the Pacific coast to the Lake of the Woods it follows the parallel of 49° N. latitude.. When this boundary was fixed, this part of the continent was unknown, and, so, natural boundaries could not be chosen. Canada and the United States have equal rights on all the Great Lakes except one—which is that ?

Size.—The area of this part of the Empire is about twice that of the Indian part of it. For man's uses, however, it is really much smaller than India, because, as we learned, large areas in the north are too cold for crops to grow or even for man to live.

Coast-line. (1) **The Arctic Coasts** on the north form part of the Barren Lands which in Asia are called Tundras. The seas and straits are full of ice for most of the year, and so there

are no harbours and no inhabitants except some scattered tribes of Eskimos who live by hunting seals and fishing. Little is known of this part of Canada. On maps many parts are blank or marked with dotted lines to show they are still unexplored. The few names we read on large maps are those given to straits, seas and islands in honour of the brave sea-captains, who, sailing from other lands, have risked or lost their lives in exploring these ice-covered waters.

V. Stefansson.

FIG. 175.—Esquimo Tent and Dogs on the Cold Barren Lands.

(2) **Hudson Bay**, about half the size of the peninsula of India, is connected with the Atlantic by Hudson Strait. It is an important question for Canada whether this strait can be used to allow vessels to reach Port Nelson on the bay and carry cargoes of wheat to Europe. At the best this strait would be free of ice for only two or three months in summer, but it would be a shorter and cheaper route for goods to and from Western Canada than by the St. Lawrence route. This bay gave its name to a great trading company something like the East India Company. At suitable spots on its coasts the Hudson Bay Company built forts or factories and bought the skins of white bears, foxes and other Arctic animals,

selling in exchange blankets, knives and guns to the Red Indian trappers.

(3) **The Gulf of St. Lawrence**, protected by the islands of Newfoundland and Cape Breton, is the chief sea-gate of Canada. The Labrador current blocks the river and harbours with ice for several months.

(4) **The West Coast**.—Here Canada is much more fortunate. As in the east, the coast has sunk and is broken by a fringe

FIG. 176.—A Fur Trader's Station in North Canada.

of protecting islands of which Vancouver Island and the Charlotte group are the most important. But, owing to the warm Pacific Drift, these sounds and straits are free of ice all the year round. Canada's Pacific gate is always open.

Lakes.—In one way Canada is very different from India. Not only are its coasts very much more broken by inlets of the sea, but when we go inland we find the interior also is broken up by lakes of fresh water. Only the largest of them are marked on the map ; but there are thousands—most of them in Canada, but many in the United States. The

Great Lakes—Superior, Michigan, Huron, Erie and Ontario—are said to contain more than half the fresh water on the world's surface. Superior alone is nearly one quarter of the area of the Bombay Presidency and the largest fresh water lake in the world. There are nine others, each over 100 miles in length. The map shows the northern half of the continent is dotted over with these lakes. In the south there are none. Surely this has not happened by chance ?

Their formation.—The story of how these lakes were formed is very wonderful. In this part of the world (and the same thing happened in northern Europe) after the work of denudation had been going on for ages and the mountains, plains and valleys had been formed, there came an Ice Age over the world when the temperature was very much lower than it is to-day. During the Ice Age in India the whole of the Himalayas and Tibet was covered with glaciers. In America a vast ice-sheet or glacier covered the whole of Canada and parts of the United States, just as a thick ice-sheet covers Greenland to-day. This ice-sheet was in many places a mile thick. As it slowly moved, it carried on the work of denudation and deposition, just as happens with the glaciers of the Himalayas now. It was like a heavy plough that swept away the soil and scraped down the rocks, over which it slipped. We can see its scratches on the rocks to-day. At last, after thousands of years, this great ice-sheet melted away. No one can tell why the Ice Age came over the earth nor why it passed away, but there is no doubt it came.

It was this great ice-sheet that formed the lakes. It did this work very much as ryots in India make tanks. Its great weight scooped out hollows in the rocks. Then, as it melted, it let fall the load of clay and stones frozen in its bottom. Where it melted fast, much would be dropped and would form low hills. In some places this load filled up the ends of valleys and formed dams across them. In these hollows and behind the dams lakes collected. When, at last, the ice-sheet disappeared, the land was covered with them. Even the Great Lakes were formed in this way.

drainage system of Canada is very simple. ng into the Arctic and its seas are of but drain out of small lakes into Hudson Bay. fairly large but all, except the Nelson which nipeg, are very little used and very little not a single harbour on this large bay , and not a single town within 200 miles zie, which is fed by large tributaries and he central plains and flows into the Arctic.

FIG. 177.—Niagara Falls.

It is as long as the Ganges, but is much less important, as during many months it is frozen, and it flows into a cold harbourless ocean full of ice. Into the Pacific flows the Fraser by a steep zig-zag course. Owing to its steep course it is not of much use for navigation even by boats, but its valley makes a gateway across the high land, and is used by one of the railways. On the Atlantic side a very different story has to be told. The St. Lawrence River and the Great Lakes which feed it form a system of navigation for sea-going ships which has no equal in any other continent. This great waterway is a natural one, but here and there man has improved it by deepening the bed and digging canals. Thus the

Niagara River, which joins Lakes Erie and Ontario, falls over a cliff and forms the greatest waterfall in the world. To avoid this, a canal was made to join the lakes. Another very important canal is the 'Soo,' only about a mile long, which gives a deep waterway between Lakes Superior and Huron. Thus sea-going ships can steam half-way across Canada from the St. Lawrence Gulf, up the river and through the Lakes to Port Arthur and Duluth at the west end of Superior, a distance of over 2000 miles, or farther than from Cape Çomorin to the north of Kashmir. The St. Lawrence river connects the Atlantic with a freshwater area one-half the size of the Indian Empire. There are many ports on these lakes both on their Canadian and United States shores. More steamer traffic passes through the Soo Canal in the seven months during which it is free from ice than through the Suez Canal during the whole year.

No greater contrast can be drawn than that between the unbroken, almost harbourless, coast of India and the far-reaching inlets of the sea-margins of Canada.

CHAPTER LXX.

THE GULF PROVINCES—NEWFOUNDLAND AND THE CANADIAN MARITIME PROVINCES OF NOVA SCOTIA, CAPE BRETON ISLAND, AND NEW BRUNSWICK.

Map Studies.—We enter Canada from the Atlantic side by the Gulf of St. Lawrence. The triangular island of Newfoundland blocks the mouth of this gulf. Its Atlantic coasts are so broken that the island seems made up of bays and peninsulas. Only a narrow strait separates it from the equally broken coast of Labrador. The other coasts of the gulf are also broken. To the north, west and south, peninsulas face us. The huge peninsula and table-land of Labrador lies to the north. The one immediately to the west is the peninsula of Gaspé, a part of the larger peninsula formed by the Atlantic coast and the St. Lawrence estuary parallel to it. Joined to this broad peninsula is the smaller hammer-shaped peninsula of Nova Scotia, behind which the Atlantic sends a long arm called the Bay of Fundy. Separated from Nova Scotia by a narrow strait lies Cape Breton Island, which is itself nearly cut in two by an inlet. The Gulf of St. Lawrence contains many islands. This region is really the north-east end of the eastern high land of North America, the edges of which have sunk beneath the sea. This high land, as the map shows, stretches in a north-east and south-west direction. The St. Lawrence river and estuary is really a deep crack or split across this line separating the Appalachian part of the eastern high land on its right or southern bank from the Laurentian table-land on its left.

Climate.—Owing to the nearness of the Atlantic, the climate of these provinces is not so extreme as that of the central plains of Canada. The winters are indeed long and cold, but not nearly so cold as they are west of the Great Lakes. The summers, though not so warm as in the far west, are warm enough to grow the crops of temperate regions. The nearness of the Atlantic gives a good rainfall and in winter the snow lies deep. The cold Labrador current hugs the shores of Newfoundland and in winter blocks its coasts and those of the gulf and estuary of the St. Lawrence with ice. The cool air over this current meeting the warm moist air blowing in from the Gulf Stream, produces heavy mists along the coasts. These are naturally a great drawback to navigation. Sometimes steamers are stopped for days by thick fog from attempting to enter the St. Lawrence estuary, and fog-horns sound warnings from the light-houses along the coast. This dampness and the good rainfall favour the growth of forests, and all the Gulf Provinces are, therefore, thickly clothed with them. The commonest trees are cone-bearers such as spruces.

From what has been said we can make one or two general statements about the Gulf Provinces which it is important to remember.

1. The extremely broken coasts with sheltered bays naturally breed a race of sailors and fishermen. Most of the inhabitants live within sound or sight of the sea, and the chief towns as well as most villages are built round harbours along the coast or on the tidal waters of rivers. The coast waters are shallow and the Labrador current brings an abundance of fish food so that the narrow seas teem with fish. In fact, the provinces depend largely on fisheries for their wealth.

2. The immense forests are a second source of wealth. In the winter season, when but little work can be done on the farms, bands of lumberers camp in the forests, where they fell the trees and drag them over the hardened smooth and slippery snow to the banks of the numerous rivers. There the trunks remain till summer when the snow and ice are gone and the

rivers can carry them down to mills which saw them into logs or grind them to pulp for making paper.

3 Agriculture is not so important in these provinces as in the milder, ripening climate, and on the deeper and richer soil of Western Canada. It is carried on chiefly in the sheltered valleys.

We shall see these points illustrated in the geography of each of the provinces.

Newfoundland : Map Study.—This rugged island is nearly twice as large as Ceylon ; its coasts are broken into hundreds of bays and peninsulas. The interior consists of forest-covered hills with numberless lakes and marshes in the hollows. The forests supply spruce logs for wood-pulp mills. Owing to the influence of the icy Labrador current, the climate is colder and wetter than that of the other provinces. Most of the island is indeed bleak and unsuited to agriculture, but in some of the sheltered valleys oats, barley and vegetables can be grown. But the Newfoundlander looks, and has always looked, to the sea rather than to the land for his living. Most of the people are fishermen. The chief fishing-grounds are the famous Newfoundland Banks, a submerged mud-covered platform, less than 300 feet below the surface of the sea and stretching for 300 miles into the Atlantic. This is the finest fishing-ground for cod in the world. Millions and millions of these fish are caught here every season, salted and sent to all parts of the world. Seal fishing (for skins and oil) is another branch of the same industry. The seals are killed on the ice-floes brought down by the cold current along the Labrador coasts. Herring, salmon and lobster are also caught in large numbers. About ninety per cent. of the exports of Newfoundland are made up of fish in some form or other. The well-known medicine, cod-liver oil, is one of them.

St. Johns, on a magnificent sheltered harbour, on the Atlantic coast and on the edge of the Great Banks, is the capital and chief fishing centre. As St. Johns is the nearest port in America to Great Britain, it is thought that some day

it may become the ocean terminus of a great trans-Atlantic route.

Nova Scotia : Map Study.—This consists of a long and rather narrow peninsula and the rocky island of Cape Breton. It is like Newfoundland, for its coasts are deeply indented and the interior is made up of low, forest-covered hills with lakes and marshes in the valleys. But here, too, the chief industry is fishing and for the same reasons.

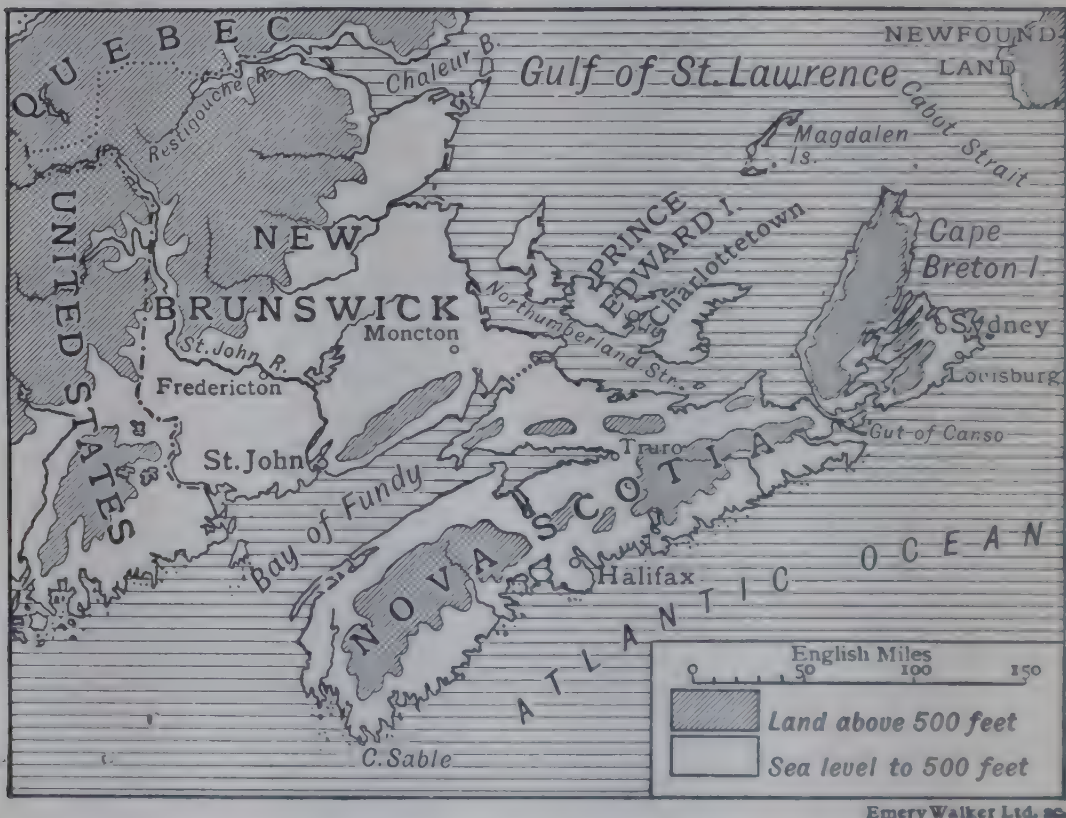
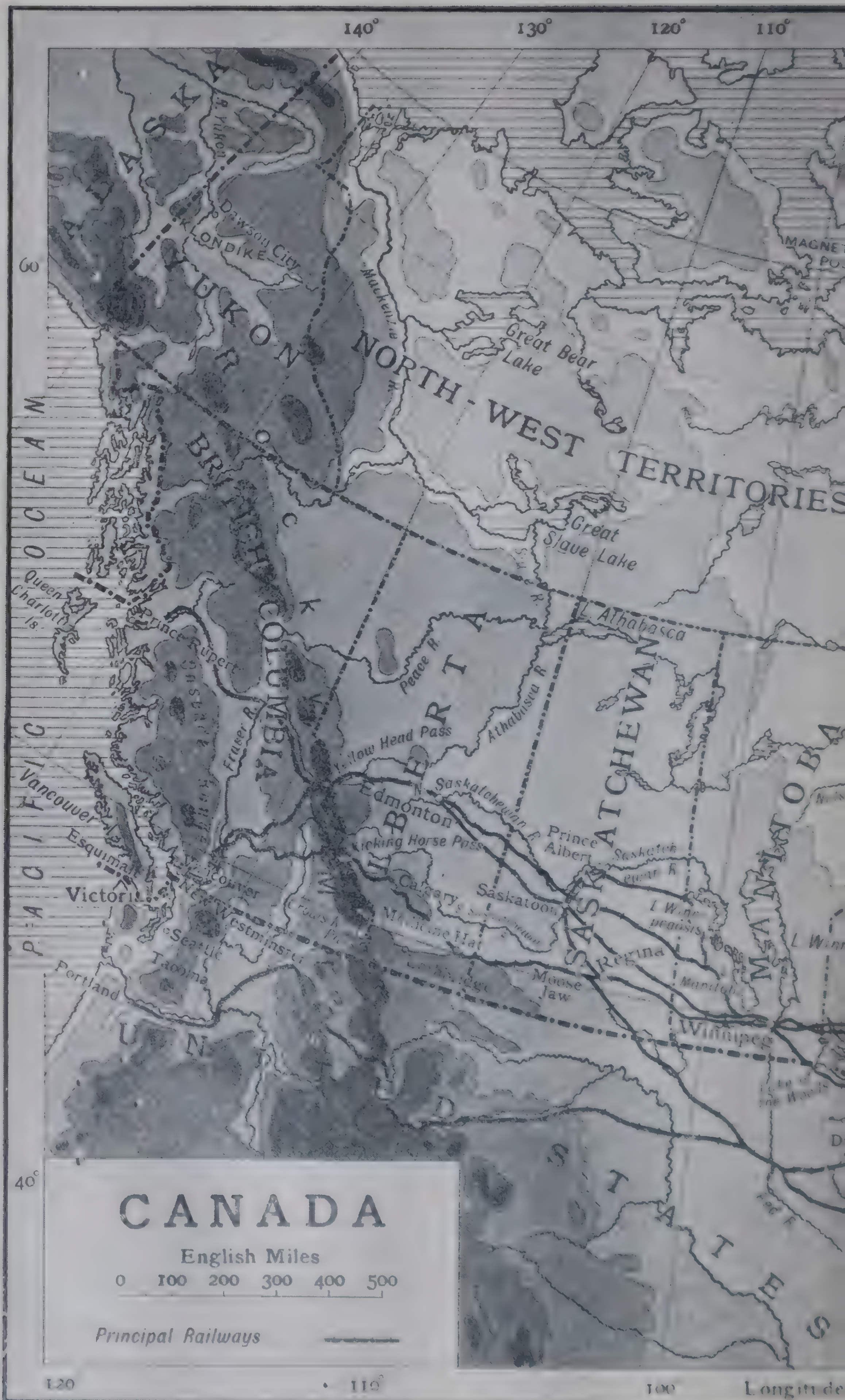


FIG. 178.—The Maritime Provinces of Canada.

The chief towns and harbours are Halifax on the Atlantic coast of Nova Scotia and Sydney in Cape Breton. **Halifax**, owing to its position, is one of the most important towns in Canada. It is built round a magnificent, sheltered, and ice-free harbour, and is, therefore, one of the Atlantic sea-gates of Canada, especially in winter when the St. Lawrence ports are blocked with ice for four or five months. The main Canadian lines run into it. One goes to Quebec and another to Montreal.



CANADA
English Miles
0 100 200 300 400 500
Principal Railways
140°
130°
120°
110°
60
40°
120
110
100
Longitude
PACIFIC OCEAN
ALASKA
YUKON
KLONDIKE
Dawson City
NORTH-WEST TERRITORIES
Great Bear Lake
Great Slave Lake
L. Athabasca
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
Queen Charlotte Is.
Prince Rupert
Fraser R.
Peace R.
Athabasca R.
Yellow Head Pass
Edmonton
N. Saskatchewan R.
Prince Albert
Kicking Horse Pass
Calgary
Saskatoon
Vancouver I.
Esquimalt
Victoria
Vancouver
New Westminster
Seattle
Tacoma
Portland
Regina
Moose Jaw
Winnipeg
UNITED STATES


80°
70°
60°
50°
40°
Baffin Bay
Baffin Land
Davis Strait
Frobisher B.
Hudson Strait
Hudson Bay
Labrador
Peninsula
QUEBEC
ONTARIO
St. James Bay
Str. of Belle Isle
NEWFOUNDLAND
St. Johns
Anticosti
C. Gaspé
Gulf of St. Lawrence
St. Lawrence
PR. EDWARD I.
Sydney
C. Breton I.
Gut of Canso
NEW BRUNSWICK
St. John
NOVA SCOTIA
Halifax
B. of Fundy
Quebec
Montreal
Cobalt
Sudbury
Ottawa R.
Ottawa
Kingston
L. Champlain
Portland
Boston
Toronto
L. Ontario
Huron
London
Niagara Falls
Buffalo
Hamilton
Detroit
L. Erie
New York
NEW ENGLAND
ATLANTIC OCEAN
60°
50°
40°
Greenwich
80
70°
Emery Walker Ltd. sc.

New Brunswick is connected with the peninsula of Nova Scotia by a narrow neck of land. Its shores on the St. Lawrence gulf are ice-blocked in winter, but those along the warmer Bay of Fundy are free of ice all the year. Here, therefore, as we should expect, we find the chief harbour, **St. John**. It is deep, well sheltered and free from ice owing to the high tides of the Bay of Fundy. Like Halifax, it is a winter sea-gate of Canadian trade and, in that season, is her chief trade port. The main line runs nearly straight westwards through a part of the United States to Montreal.

CHAPTER LXXI.

THE ST. LAWRENCE AND LAKE PROVINCE OF CANADA—QUEBEC AND ONTARIO.

Map Study : Quebec.—Leaving the Gulf Provinces behind, we sail up the estuary of the St. Lawrence. The student should notice that we are sailing not west but south-west and away from the open ocean. The climate, therefore, becomes on the whole milder but more extreme. The winters, are, indeed, more severe but the summers are longer and much warmer. On our left we pass along the ends of the Appalachian Chain. On the right we see the edges of the great high land or plateau that stretches across half of Canada from the rugged coast of Labrador to Lake Winnipeg. Between these two high lands winds the plain of the St. Lawrence—a long, narrow, low-lying fertile valley. This is the most important part of Quebec. Oats, barley, hay and a little wheat are the chief crops. Though the winter is severe, the warm, dry summers ripen corn and fruit to perfection. Apple and pear orchards are seen everywhere and the rich pastures contain many dairy farms which export large quantities of butter and cheese to Great Britain and Europe. Canadian cheese is, indeed, one of the commonest articles of food in England and Scotland. Lumbering is one of the leading industries of Quebec province. The immense forests of pine and spruce on the land on either side of the river afford an almost limitless supply of timber, and the numerous lakes, rivers and waterfalls are of the greatest use in floating the timber to the mills and in driving the mills themselves. The rivers of Canada produce very large amounts of electric power.

The province of Quebec, which now includes the immense area stretching east of the Ottawa river, St. James Bay and Hudson Bay and north and south of the St. Lawrence, has an area as large as the six largest provinces of India put together. The chief towns are, as we should expect, seaports on the St. Lawrence. Two of them are of special importance—Quebec and Montreal. **Quebec**, the capital of the province, owes its importance to its harbour, which is one of the best in North America and is deep enough to hold the largest vessels. It is, however, blocked by ice for five months in winter. A wide belt of cone-bearing forest stretches across northern Canada. The logs are floated down the river and are here sawn into planks or made into furniture and exported. Every furniture-maker and carpenter in Great Britain uses Canadian pine. This province produces more than half the asbestos in the world.

Montreal, on an island in the river, is the largest city and the chief seaport of Canada. The map shows how its position gives it importance. At Montreal the cargoes of the largest ocean-going steamers must be transferred to smaller vessels. It stands at the gateway of the greatest system of fresh-water navigation in the world. No position could be more favourable for commerce. But the city is the meeting-place of other natural routes as well. The Ottawa river and valley make it the gateway of boat and railway traffic up that river. Then, on the other side of the St. Lawrence, a natural depression connects it due south by water and rail with New York, the largest city of the United States. The position of Montreal has thus made it the meeting-place of the out-going and in-coming sea-trade of the Dominion and the centre from which it is distributed by rail, river and canal.

Ontario : Map Study.—Leaving Montreal and continuing our voyage up the St. Lawrence we soon find ourselves in Ontario. This province touches four of the Great Lakes and is often called the Lake Province. It includes the whole of the Lake Peninsula between the Huron, Erie and Ontario lakes on the one side and the Ottawa and St. Lawrence rivers on the other. Long ages ago Ontario was, like the rest of

FIG. 190. — Part of the Harbour at Montreal showing the River Steamers. (By courtesy of the Canadian Pacific Railway.)

Canada, covered by a thick ice sheet, and the whole of the St. Lawrence valley was blocked by an immense dam of ice, so that the lake area was much wider and deeper than it is now. The Lake Peninsula was then part of the floor of an immense lake and was covered with the till, or rock waste, produced by the ice. When the dam in the St. Lawrence estuary melted away, much of the lake water escaped, the level of the lakes was naturally lowered, and all the peninsula became dry land. But its deposits of *till* remained, so that its soil is now very fertile. It is the most fully cultivated and thickly populated part of Canada. Here the original forest has long been cleared and the land is entirely used for the cultivation of corn, the growing of fruit and the breeding of cattle and horses. Oats, barley and wheat are widely grown. The soil and dry, ripening climate are particularly well suited to the growth of fruits such as grapes, apples and peaches. The farmers export much of the Canadian butter and cheese so well known in England.

The rest of the province consists of the rocky plateau in the north where the soil is thin and only forests of fir and pine can grow. Lumbering is here, therefore, the chief industry. In eastern Canada there are no large towns far from the valley of the St. Lawrence and the lakes.

Towns.—Owing to its fertile lake peninsula, Ontario, though a smaller province than Quebec, has a larger population, and contains many growing towns. They are the markets for the farms and pastures round about, exporting their crops, fruit, butter and cheese, and manufacturing or importing the machines, tools and clothing they need. The largest of them share in the great traffic of the lakes and river and in their fisheries.

Ottawa, the capital of Canada, where the Dominion Parliament sits, is finely situated on the high south bank of the Ottawa River, just where great falls stop navigation up-stream but yield plenty of water-power for mills. It is, accordingly, the chief lumber centre of Canada, where timber, floated down the river from the forests, is sawn or pulped. This water-power

is also used to drive match-mills, flour-mills, to provide electric light for the city and to drive the engines on its electric railways.

On the main railway line (the Canadian Pacific), across the peninsula joining Montreal with Detroit and Chicago (in the United States) lie the other chief towns of the province —Kingston, Toronto, Hamilton and London. **Kingston** stands on the busiest harbour on Ontario Lake. **Toronto,** the capital of Ontario province, has a good new harbour near the west end of the lake. From its position it is an important centre of trade and from it railway lines branch out all over the peninsula.

Fort William and **Port Arthur**, close together on the western end of Lake Superior, are growing rapidly. They are important on account of their position at the head of lake navigation and because they are the natural outlets for the wheat crops of the western prairies. These crops are brought to them by rail and shipped on board lake steamers bound for lake ports or even down the St. Lawrence and across the Atlantic. On the main line from Ottawa to Port Arthur we pass **Sudbury**, which has the richest nickel mines in the world and produces more than the rest of the world put together. When we handle an anna coin we may be pretty sure it came from Sudbury. At **Cobalt**, north of Sudbury, very rich silver mines have recently been discovered, and they have helped Canada to take the third place (next after Mexico and the United States) among silver-producing countries. Gold has recently been discovered and is being mined in this province.

CHAPTER LXXII.

THE PRAIRIE PROVINCES OF CANADA—MANITOBA SASKATCHEWAN AND ALBERTA.

Map Studies.—When we reach the Lake of the Woods, west of Lake Superior, we leave behind the rocky, forest-covered plateau of the Lake Province and enter a new land.

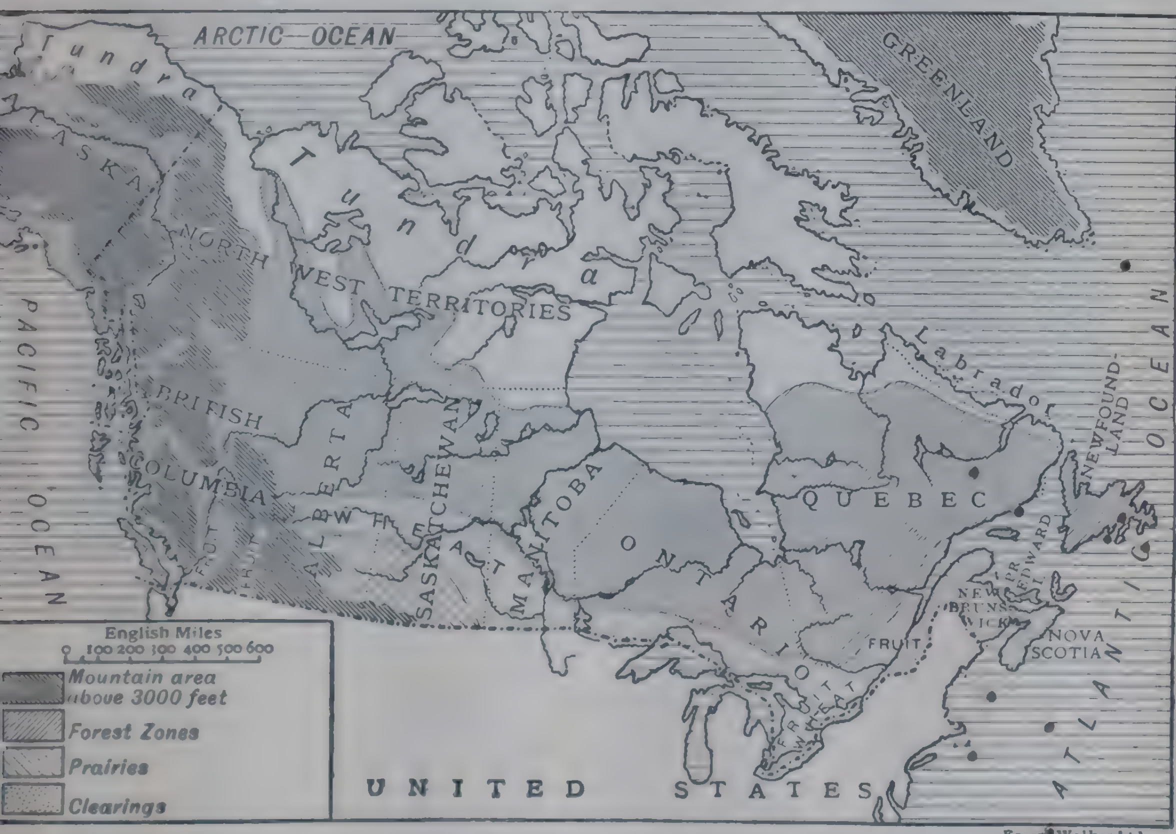


FIG. 181.—The Natural Vegetation of Canada.

This is the central plain of Canada which stretches westwards, with a slope rising to the Rocky Mountains, and is taken up by the three prairie provinces. These three provinces are the

great corn-lands of Canada to which, in recent years, has flowed an enormous stream of settlers from Europe and the United States. In the first ten years of this century their population was doubled.

The Soil.—The reason for this immigration is the fertility of the soil. It can be cultivated year after year without manure and is particularly suited to the growth of wheat.

FIG. 182.—Ploughing with Machine Ploughs on the Prairies of Canada.

An expert who has examined it says, "The first foot of soil in the three provinces of Manitoba, Saskatchewan and Alberta is their greatest natural heritage. It is worth more than all the mines in the mountains from Alaska to Mexico and more than all the forests from the United States boundary to the Arctic Sea." Then, again, there are no dense forests to clear away, no wild animals or fever to dread, the Canadian Government offers farm-lands free to suitable settlers and the railways help newcomers in every way. These prairie provinces form the

greatest corn-growing region in the world—wider than that of Russia and richer than those of India, Egypt or the Argentine.

The Climate, as well as the soil, helps the fertility. In a region so far from the sea the winters are of course very cold—'zero cold'—and milk is then sold in solid lumps—but to Europeans they are very bracing. No beggar can live in Canada during the cold season. The hard frost seals up the moisture in the ground and makes the soil very crumbly and

FIG. 183.—Cutting Wheat with Machines on the Prairies of Canada.

easy to plough when the spring comes. The rainfall is small—much less than in most parts of India—but most of it falls in summer just when the farmer needs it to fill the ears of his corn. The air is dry and the sky clear, just as in the Punjab, and this exactly suits the growth of wheat. Even the snow that falls in winter does no harm. It prevents the frost from killing the young wheat plants, and in spring it melts and gives them moisture enough to send their roots deep into the ground. Lastly, owing to the distance from the equator, the sun in summer shines from a clear sky for as much as eighteen hours

out of the twenty-four and this ripens the wheat crop perfectly. The whole of Central Canada gets more sunshine than any part of Great Britain, Holland, Germany or Northern France. It is the splendid ripening sun that makes Canada such a large producer of wheat and fruit.

Manitoba : Map Study.—A large part of this province is taken up with the lakes of Winnipeg, Winnipegosis, Manitoba and several smaller ones connected with them by rivers. The whole of this flat prairie was once the floor of an ancient fresh-water sea of which these lakes are the parts that are left. The Red River valley sloping northwards to Lake Winnipeg is another part of this old lake bottom, and its deep soil makes it one of the most fertile wheat-growing regions in the world. For miles and miles in all directions over this province we see rich farm-lands growing crops of wheat, barley, oats and flax. In such a new country where most of the people are farmers we can expect but few towns.

Winnipeg is the only large city but it is unlike our old slow-growing towns. People are still alive who remember it as a small fort of the Hudson Bay Company : its population is now two lakhs. What is the reason of this rapid growth ? One reason is that during the last forty years the amount of wheat grown in its province has increased nearly 600 times. The map shows us other reasons. It lies on the Red River and at the end of its valley where it enters the lake. Again, it is the gateway leading to the vast fertile corn-lands of Manitoba, Saskatchewan and Alberta. All this region is becoming more populous every year, more land is being ploughed and more food grown. Its vast harvests going east pass through Winnipeg which is therefore the largest grain-market in the world. Its position also makes it one of the most important railway centres in America. Every line is forced to pass, as through a gate, across the narrow belt between the southern boundary and Lake Winnipeg. There is little room anywhere else. Winnipeg stands on this narrow belt. The two main lines across Canada and over a score of other lines meet in the town. Winnipeg is for railways what Singapore is for ships.

Saskatchewan : Map Study.—This province, like Manitoba, is strewn with lakes but they are much smaller. Although as yet only a fraction of its land is cultivated, Saskatchewan is among the chief of American wheat-producing states. Wheat, oats, barley and flax are again the principal crops. There are but few towns. **Regina** and **Moose Jaw** lie on the main line (C.P.R.) to the Pacific and are growing farming centres and markets.

Alberta: Map Study.—Alberta occupies the highest part of the Canadian plains, and, as we can see by the flow of the rivers, it slopes gently down to the east and north. We are now in sight of the snowy peaks of the Rockies.

Like the other prairie provinces, Alberta is covered with a deep, black, fertile soil; farms are everywhere and wheat, barley and oats are the main crops. Southern Alberta, lying close under the rain-screen of the Rockies, was for long thought to be too dry for wheat-farming, and was therefore given over to cattle-breeding. The warm, moist winds blowing inland from the Pacific lose their moisture in crossing these ranges and sweep down the eastern slopes as dry breezes called Chinook winds. When they blow, they raise the temperature quickly and lick up the snow so that cattle and horses can pass the winter out of doors without having to be fed with grain or even hay. In recent years, however, it has been found that by making irrigation works on the slopes of the Rockies good crops of wheat can be grown even in the driest districts.

As we should expect, the population is, as yet, very thin. Alberta, though able to support a large number of farmers, has at present fewer inhabitants than Bombay City. **Edmonton**, in the centre of the cultivated part of the province, is the chief town. **Calgary**, the capital, close to the foot of the Rockies, is another farming centre. **Medicine Hat**, farther east, is another farming and cattle-breeding centre. Near it are enormous fields of natural gas, which is used to light the streets and houses and to drive all kinds of engines.

CHAPTER LXXIII.

THE PACIFIC PROVINCE—BRITISH COLUMBIA. NORTHERN CANADA.

Map Study.—When we leave Alberta and climb the crest of the Rocky Mountains, we are in British Columbia and have

FIG. 184.—A Train passing through a Valley in the Rocky Mountains.
(By the courtesy of the C.P.R.)

left the flat prairies behind. We find ourselves in an entirely new land. Instead of wide plains we see range after range of

magnificent mountains. Their sides slope steeply down to deep valleys, their shoulders are clad with dense forests of splendid trees and their tops are covered with glaciers and snow-fields, which feed the rivers and lakes at their feet.

Fortunately there are several passes in the barrier of the Rockies through which railways enter the province from the

FIG. 185.—A Mountain, River and Railway Station in the Rocky Mountains.

east. Behind the Rockies there is a deep and narrow trough running north and south the whole length of the province. In this trough the Fraser River flows for part of its course. Crossing this trough we come to two other ranges which stretch for a long distance northwards and are as difficult to climb as the lofty Rockies themselves. Beyond these ranges we reach the table-land of Columbia, occupying the centre of the province. Seaward from this table-land stretches the Cascade, or Coast Range, rising higher than the Western Ghats, and forming the western edge of Canada. British

Columbia is thus made up of ranges of mountains running nearly parallel, with a table-land in the middle and a broken fiord coast on the Pacific.

The Climate, too, is very different from that of the prairie provinces: it is very like that of Western Europe. The warm Pacific Drift and the prevailing westerly winds carry clouds full of moisture in from the ocean. These are blown up the narrow valleys and strike the sides of the mountains far inland. The coast and the highest ranges thus receive plenty of rain. On the mountains in the eastern part of the province the climate is cold, and on the Rockies the snow lies deep.

Vegetation.—The damp winds favour the growth of forests and grass. The trees are, of course, different from the teak and other trees of India and of other hot countries. They are chiefly of the cone-bearing family. The Douglas fir, growing as high as 300 feet, is found on Vancouver Island and the slopes of the Coast Range. The wood of these trees is not so hard nor so heavy as teak, but it is easier to work. But at present the chief wealth of the province consists in its minerals. The mountains in the interior yield gold and silver, lead and copper. Rich coal mines are worked near the Crow's Nest Pass, in Vancouver Island and in Queen Charlotte Island farther north. Vancouver has thus become the chief market for coal on the Pacific Coast. This is enough to make it an important seaport.

Fisheries are very important—both in the rivers and the sea. Immense shoals of salmon run up the rivers from the sea. They are caught in large numbers, canned and sent abroad. Many kinds of sea-fish are also caught, and ships are sent to the seal-fishing among the islands to the north.

Towns.—The population is about five lakhs: the province could support two crores. In this respect it is quite unlike an old and densely-peopled country such as India. It is really separated by the lofty and broad Rocky Mountains from the rest of Canada, and its development depends on how fast the railways across these mountains can bring settlers from Europe and Canada. Without these railways British Columbia would

be a province by itself. With such a small population we do not expect to find large towns.

Victoria, the capital, stands on a good sheltered harbour in the south end of Vancouver Island. Close to it is **Esquimalt**, which has a finer harbour. **Vancouver**, the chief city and sea-port, stands on a long inlet on the mainland a little north of the mouth of the Fraser River. Its splendidly sheltered, ice-free harbour is one of the finest in the world. It has thus become the chief Pacific seaport of Canada and its gateway for sea trade across the Atlantic to Eastern Asia. The main trans-continental railways of the Dominion end here, and from it radiate the steam-ship routes to Japan, China, Australia and the Pacific ports of North and South America. Since the opening of the Panama Canal Vancouver has become a centre for shipping wheat, grown on the prairies of Canada, to Europe, and timber to New York. **New Westminster**, a few miles up the Fraser River, is the centre of the salmon-catching industry.

Follow on the map the two main railway lines running to the Pacific coast from Winnipeg :—(1) The C.P.R. through Regina, Moose Jaw and Calgary over the Rocky Mountains by the Kicking Horse Pass and then along gorges, through tunnels and across bridges spanning mountain rivers, down to Vancouver near the mouth of the Fraser River ; (2) the G.T.R. (Grand Trunk Railway) by a more northerly route through Edmonton across the Yellowhead Pass to Prince Rupert, a harbour at the mouth of the Skeena River.

Northern Canada—Yukon and the North-West Territories : Map Study.—The rest of Canada though very large—larger than the Indian Empire—is, on account of its climate, of little value, and the total population is less than 50,000. **Yukon** is drained by two rivers which, in Alaska, join to form the Yukon River. The climate is very severe and extremely cold in winter, when the thermometer falls far below zero and every lake and river is frozen for several months.

The North-West Territories, as the map shows, occupy the large area between Yukon and Hudson Bay, and include

the groups of islands to the far north. They are covered with lakes and marshes. The northern districts form parts of the Tundra or Barren Lands, which only grow enough moss for herds of Caribou—a kind of deer. The rest of the territories lies in the forest belt, the trees being stunted in the north but larger and more valuable farther south. Unlike Southern Canada, these territories can never be thickly settled (Fig. 181).

CHAPTER LXXIV.

THE UNITED STATES.

Its Size and Importance.—We now come to the part of North America occupied by the United States. The geography of this country is of interest to us because no other presents greater contrasts with India. India was a grandmother before the United States was born. In Akbar's reign this land was scarcely known, but no part of the world has had a greater history since. In fact, when we study the geography of America we can only clearly understand it, if we remember we are really trying to learn what kind of land this is, which, 300 years ago, was almost entirely unexplored and is now the home of a large part of the human race.

THE ATLANTIC COAST PLAIN.

New England, the northern part of this coast, was the first to be settled by colonists from Great Britain, for it was the part nearest to their old home, and its broken coasts offered good, sheltered sites for harbours. A large proportion of the people win their living on the sea, either as sailors or fishermen. The Grand Banks of Newfoundland are near and the coasts teem with fish of many kinds.

Chief Towns.—Boston is the largest seaport, and is second to New York among the seaports of the United States. It has a fine harbour protected by several small islands, and in consequence is an important gateway of trade. **Portland** is another large seaport with a fine harbour. Like Halifax and St. John, it is one of the winter sea-gates of Canada when the St.

Lawrence is frozen, being the terminus of one of the trans-continental lines across that country through Montreal.

The Atlantic Coast Plain.—Map Study: Relief, Climate and Products.—In New England the rugged table-land comes down quite close to the coast but, when we go south and across the Hudson, the coast plain widens and stretches between the eastern high land and the Atlantic as far as the low-lying peninsula of Florida. The climate of this coast-plain becomes warmer as we go south, partly because we are getting nearer the equator and partly because we are getting farther from the cold Labrador current and nearer to the warm Gulf Stream. The region also receives a good rainfall from storms sweeping in from the Atlantic. The coast plain is, therefore, fertile—much more so than the coast of New England. The crops vary with the climate—oats and wheat in the north, maize in the middle and cotton in the south. Tobacco is also an important crop in the south. There are extensive forests on the slopes of the Appalachians, and plenty of iron, coal and oil in the country behind them, so that every town on this coast-plain is engaged in many kinds of manufactures.

On a large map trace the course of the Hudson, Delaware and Potomac. These rivers cross the Appalachians and serve as gateways to the interior. We should, therefore, expect to find the largest towns on the sea-coast opposite to these gateways. The map shows us three, New York, Philadelphia and Baltimore.

Chief Towns.—**New York** is the largest and busiest city in the United States. It is next in size to London among the towns of the world for it has over five millions of inhabitants. There are several reasons why it is so important. In the first place, it is by far the largest seaport of the United States and most of the sea-trade of the Atlantic coast passes through it. Like Bombay it is partly built on an island. Behind this island vessels are safe from storms. It is also well placed for sea-trade across the Atlantic for it is practically the nearest port of this coast to the great seaports of Northern Europe. All

the passenger steamers from London, Southampton, Cherbourg, Havre and Hamburg meet in its harbour. Again, unlike Bombay, it has easy access to the interior. Just at the end of the island the Hudson River, which is really a long narrow salt-water estuary, enters the coast from the north. The tide goes up this estuary for 150 miles. At this point a river enters the estuary from the west, and along the valley of this river the Erie Canal, 350 miles long with many locks, has been dug as

Photo. Exclusive News Agency.

FIG. 186.—A Warship entering the large Harbour of New York.

far as Buffalo at the east end of Lake Erie. Now this valley gives a fairly level opening across the eastern high land so that New York is connected by water with the Great Lakes, the finest system of fresh water navigation in the world. Railways have been built along this valley so that goods can easily be carried to and from New York. It is as if Bombay, instead of having the steep Western Ghats behind it, were near the Palghat Gap along which railways and canals led into the Deccan. The city has been connected by other railways to all the chief towns of the United States and Canada. New York is really made up of several towns, partly on the island

and partly on the mainland. It is also the chief manufacturing town in the States.

Philadelphia, like New York, lies on a deep water estuary where the Delaware River enters it. Its fine harbour lies near the coal-fields inland. It is, therefore, a coal-shipping port. The coal and iron which are easily brought by rail make it a great manufacturing centre, ships, railway-wagons and machinery being three of its chief products. It is also the starting place of important railway lines. **Baltimore** is a younger sister of New York and Philadelphia. It is built round a good sheltered harbour on Chesapeake Bay. It, too, can get coal and iron by rail across the Appalachian high land and this has made it a manufacturing and shipping port. **Washington,** the capital of the United States, where Congress sits, is unlike these busy manufacturing cities. It is the seat of government with many public buildings and offices. The people of the United States have been careful to make their capital as beautiful as possible with wide streets and many parks. Architects from India have visited it in order to get ideas for the building of New Delhi. **Charleston**, further south, ships cotton grown in the cotton belt behind it.

RESOURCES AND TOWNS OF THE CENTRAL PLAIN.

Inland from the coastal plain stretches the Appalachian high land consisting of long ridges running north-east and south-west with long valleys between. These valleys are fertile and contain many small towns and villages. Beyond the ridges we reach the Appalachian plateau which slopes gradually inland down to the valleys of the Ohio and Mississippi. We are now in the wide plains of the central low land which fill up the middle of the continent. We have already learned how fertile these plains are and the reasons for this fertility.

But these central low lands besides being very fertile also produce large supplies of the minerals of which man stands most in need. On these plains or on their borders more coal and iron is mined than in all the rest of the world put together.

Coal is found in almost all parts. Petroleum and natural gas, which are much used as fuel, are also most plentiful in the Ohio valley. The United States is very fortunate in having iron deposits near its coal-fields, especially in the southern Appalachian region of which **Birmingham** is the centre. But the richest iron region in America and in the world, lies round the western end of Lake Superior, where millions of tons of iron ore are mined every year. Here, in certain parts, the surface of the earth seems to be made of iron.

As we should expect, with these large supplies of raw materials of all kinds, there are large manufactures and every town is engaged in this work more or less. The population is growing denser every year and there are many large towns scattered all over the Central Plains. They are, however, chiefly to be found on spots most convenient for trade, *i.e.* on the Great Lakes, on the chief rivers and on the sea-coasts.

Towns on the Great Lakes.—Duluth and **Superior** are twin cities at the head of lake navigation with a fine harbour. Owing to their position at the outlet of the fertile prairies of the north-west, especially the Red River valley, they ship enormous quantities of wheat down the lakes, either to be ground in the mills of cities in the eastern states or for transhipment to Europe. They both stand at the outlet of the richest iron mines in America, and here, therefore, are enormous docks, where more than half a million tons of iron ore are shipped every week to towns on the Ohio valley coal-field, where it is smelted and manufactured. On the other hand, as no coal is found in their district, these towns receive by water, and distribute by rail, enormous quantities of coal. **Milwaukee** is another distributing centre with a fine harbour on Lake Michigan. **Detroit** is a French word meaning "strait," and its position on the map shows why it got this name. Owing to this position all the water traffic between the upper and lower lakes passes through it. The city is the chief centre for the making of Ford motor-cars, many of them being yearly sent to India. **Cleveland**, on Lake Erie, is another large lake-port and railway-centre. Its traffic in coal and

iron is enormous, and it is the largest ore market in the world. A large industry is the building of iron-vessels for traffic on the lakes. **Buffalo**, on the same lake, is a distributing centre for the manufactured goods of the east and the raw products of the west. It slaughters cattle, packs meat, makes all kinds of iron goods, soap, flour, furniture and clothing.

But of all the lake cities **Chicago** is much the most important. Next to New York it is the largest city in America,

Photo. Brown Bros. N.Y.

FIG. 187.—Chicago: Tall Buildings on the Shore of Lake Michigan.

and has more inhabitants than Calcutta, Bombay and Rangoon put together. "Chicago is the greatest railway centre, the greatest grain market, the greatest live-stock market and meat-packing centre and the greatest lumber market in the world." The map shows how its position has favoured its growth from a village in less than a lifetime. In the first place, it stands on the lake system of waterways just at the point where that system reaches farthest south, and nearest the centre of the fertile plains, so that it is the easiest outlet for their products. In the second place, owing to the shape and position of Lake Michigan, railways connecting the east and

the north-west had to pass round its southern end and through the city. Chicago is thus the largest railway centre in the world. The best known business of Chicago is meat packing. Train-loads of cattle, pigs and sheep are brought in from the prairie farms every day to the slaughtering yards. The meat (beef, mutton and pork) is packed in ice and sent off to the great cities of the east, or cooked and canned for export to all parts of the world.

River Cities.—**On the Ohio.**—**Pittsburg** stands at the junction of three rivers which form the Ohio and in the midst of the most productive coal-field, oil and gas wells in America. Iron is brought from the mines round about and from the Lake Superior field. It, therefore, ranks first among the cities of America for the manufacture of all kinds of iron and steel goods, and it is the centre of the most important iron, steel, pottery and glass manufacturing district on the continent. **Cincinnati** is another large manufacturing town favoured by the river and the neighbourhood of coal mines.

On the Mississippi.—**Minneapolis** and **St. Paul** stand nearly opposite one another at the Falls of St. Anthony which is the limit of navigation on the Mississippi. The falls are used as water power to drive immense wheat-grinding mills, one of which is the largest in the world. Whole train-loads of wheat are turned into flour every day. It is easy to understand the reasons for the importance of **St. Louis**. It stands in the very middle of the great drainage basin of the Mississippi, the richest part of the continent, close to where the Missouri joins the main river. Its central position, on a navigable river flowing from north to south, makes it an important market for the wheat of the north, the maize of the centre, the cotton and tobacco of the south and the cattle of the west. Besides being a market it is also a manufacturing city. It is the chief manufacturer of tobacco in America.

On the Missouri.—**Omaha and Kansas City.**—These towns lie in the midst of a fertile grain-growing country and on the edge of the drier ranching country of the Great Plains farther west. Many railway lines meet in them.

On the Gulf of Mexico.—New Orleans may be compared with Calcutta or Rangoon. Each stands at the head of a low, flat delta, some miles up from the mouth of a river which drains a very large and fertile valley, at a spot which ocean vessels can reach though they cannot venture much farther up. Like the Hughli and the Rangoon river, the Mississippi at its delta has to be constantly dredged to keep a fairway open for these vessels. Just like Calcutta, New Orleans is the sea-gate of its broad valley. It lies near the mouth of one of the greatest navigable rivers of the world. River steamers can go right up as far as Minneapolis, or a distance equal to that from Cape Comorin to Delhi, and many of its tributaries are also used by small river steamers for long distances. Besides being much larger than the Ganges, the Mississippi has this advantage, that it flows north and south not east and west. It thus passes through districts some of which grow crops of warm climates and others of which grow those of temperate climates and it helps to exchange them. After the harvest season the wharves at New Orleans are crowded with raw produce waiting to be shipped abroad—sugar, molasses, rice and tobacco from the warmer regions in the south, wheat, oats and maize grown farther north, and the products of the drier pasture lands in the west such as meat, hides and skins. But much the most important export is cotton, grown on the broad cotton belt of the Southern States. New Orleans is the chief cotton seaport of the world, one-third of the cotton crop of the United States being shipped from it.

Towns of the Western High Land and Pacific Slope.—We have learned the reason why the western table-lands and mountains receive little rain, and we might call them the Great Deccan of America. Inland from the Gulf of California some parts are desert. The map shows but few rivers. There are forests on the highest slopes facing the Pacific and pastures in the valleys, but on these western table-lands farming is impossible without irrigation. We cannot, therefore, expect to find many towns in this region. But though the surface is not fertile, there is a great wealth of minerals buried beneath

it in different places—gold, silver, copper, lead, mercury and coal. In fact the valleys and table-lands of the Rockies are now the richest mining region of the world. There are therefore several mining towns. **Denver** lies high up on the edge of the Rockies in the middle of a very dry district. But by using the water of a mountain river to feed canals a large area has been irrigated and good crops of grain, vegetables and lucerne are grown, just as is done near many rivers in India. Furnaces in the town smelt the ores sent to it from the mining camps. **Salt Lake City,** lying in the Great Basin near Salt Lake (a centre of inland drainage), is another place which depends on irrigation—we might call it an oasis-town, and compare it with towns in the dry part of Rajputana.

On the Pacific Coast.—As the mountains here rise almost from the sea, there are few good harbours on the west coast. **San Francisco** is built on the Golden Gate, an opening where the coast has sunk and the sea has flowed in and filled up part of the low-lying valley behind. It has thus the best harbour on this coast. Behind it are fertile lands growing wheat and barley. Owing to its Mediterranean climate, the growing and packing of fruit is an important business. This fruit is sent inland and overseas. **Los Angeles,** farther south, helped by the Panama Canal, is now quite as busy a port. It exports fruit and sends oil from its wells by rail and sea. Both ports carry on a large trade with China, Japan and the islands of the Pacific. **Portland** stands about 100 miles up the Columbia river (on a tributary) and can be reached by ocean-going vessels. It is the outlet of a well-watered fertile valley where wheat is grown and sheep are bred, with forested mountain slopes behind. A good deal of the timber goes to China and Japan where there are few forests. **Seattle,** on Puget Sound, is another large port trading across the Pacific.

Alaska.—Owing to its position the climate of Alaska is not pleasant, the winters being long and very cold and the summers short and cool. In the north glaciers slip down into the sea. But further south, along the Pacific coast, owing to the pre-

vailing damp westerly winds, the climate is less severe. The peninsula of Alaska ends in a long chain of islands—many of which are volcanoes. As in other far northern lands, the population is very thin and the few inhabitants look to the sea rather than to the land for their livelihood. Fishing is, therefore, the chief industry. Whales, yielding oil and whalebone, and many kinds of seals (especially the fur seal which supplies the soft fur much used for winter cloaks in cold countries) are hunted. In recent years there has been a great "rush" of miners to the gold mines of the interior.

These are only a few of the most important of the towns of the United States. There are a hundred others. We must remember that in the United States there are over 100 millions of people. The Government of the United States, of which there are forty-eight, is a republic. A large map shows their boundaries. Why are so many of these boundaries marked by meridians of longitude and parallels of latitude?

The Railways of North America.—There is one great difference between Asia and North America. In Asia people do not travel very much and most of the land trade is carried by animals or by boats on rivers. Except in India, there are very few railways. Even in China, with its many towns and dense population, there are still only one or two. Only one line crosses the continent from east to west. In large areas there are no railways at all. In North America, however, as in Europe, man has built many iron roads. Only in this way could the crops, the food, the minerals and the manufactures of one region be carried to another across great distances. Even a large map shows only the main lines. There are hundreds of others, and new ones are always being built. In Canada there are two or three main lines, joining Montreal, Quebec, Halifax and St. John with Vancouver. The Canadian Pacific (C.P.R.) is the most important. Each has many branches, some of which join Canadian towns with towns across the boundary of the United States.

In the United States there are three or four lines running across the continent with hundreds of branches, and they are

joined up with lines going south into Mexico. Chicago, New York, Philadelphia, New Orleans, San Francisco are the most important meeting-places of these lines. A railway map tells us a great deal about a country. Where the lines are most numerous, there we know there must be most fertile land, most people and most trade and manufactures. Where there are only a few, we may be sure there are few people, and not much business or trade. Where the country is level lines can easily be made, but over mountains like the Ghats or Rockies there can only be a few.

CHAPTER LXXV.

TROPICAL LANDS OF THE CONTINENT.

MEXICO—CENTRAL AMERICA—THE WEST INDIES.

Mexico : Map Study.—Mexico is the thick thigh-like part of the long tapering isthmus connecting North and South America. It is almost exactly half the size of India and, as

FIG. 188.—The table-land of Mexico. (See also Fig. 174).

the Tropic of Cancer passes across the middle of it, its position on the globe corresponds to that of Northern India. Besides this broad part of the mainland it also includes the long.

narrow, hilly peninsula of Lower California stretching southwards into the Pacific and the low, short, blunt peninsula of Yucatan, jutting northward into the Gulf of Mexico and forming one of its jaws.

Relief.—Mexico is an extension southwards of the western high land of North America and consists of a table-land nearly twice as high as the Deccan, flanked on its Pacific side by the Western Sierra Madre and on its Atlantic side by the Eastern Sierra Madre. The southern end of this table-land is blocked up by a high belt of volcanoes, stretching from sea to sea across the narrow isthmus of Tehuantepec. The lofty table-land of Mexico is thus very difficult to reach from either coast. Without railways it would be shut off from the rest of the world. The highest peaks of the volcanic belt are Orizaba, Popocatepetl and Colima, all of them thrice the height of our highest Ghats. Near these volcanoes earthquakes often occur. The coast strips between these flanking ranges and the sea remind us of the Konkan and Malabar coasts.

Climate and Vegetation.—Mexico has a curious mixture of climates. Owing to latitude the heat on the low coast-lands is much the same as that on our own. On the eastern coasts the rainfall is like that on our coast-strips and falls in the hot season (May to October). The rainfall is heaviest in the south and decreases as we go north. Northern Mexico, including the peninsula of California, being outside the rain-belt, is very dry and many parts of it are desert. This corresponds to the Indian Thar. The Rio Grande (Great River) is often nearly dry. The main part of Mexico being a lofty table-land twice as high as the Deccan, with flanking ranges much higher than the Eastern and Western Ghats, its climate is that of the Deccan—only much exaggerated. There is enough pasture to feed cattle and sheep, but, where no irrigation is possible, the plants are those of arid regions, *e.g.* cactuses. The heat on this plateau, is, owing to elevation, less than on the Deccan. Though the days are hot, the nights are cold. Even snow falls occasionally. On the coast-lands it is different. Here from

sea-level to 3000 feet we have a climate and vegetation like that of the Konkan. The sun is very hot, the rainfall is heavy and the air is always damp. Thick jungles cover the low-lying tracts and in the clearings crops of sugar-cane, rice, plantains, oranges and limes are grown and the backwaters are lined with coco-nut groves. Here, in the damp forests, mahogany, ebony, rubber, wild fig-trees and dye-woods grow wild. The soil, being volcanic, is fertile.

Minerals.—Mexico depends on her minerals more than on agriculture. Mining has for centuries been the chief business of the people. It was the silver mines of the country that led the Spaniards to conquer it. Mexico is the chief silver-producing country in the world. Gold, platinum, mercury, sulphur (in the volcanoes), copper and lead are also plentiful. Mexico has much richer oil-wells than Burma. Its wells produce more oil than any country except the United States. Lakhs of barrels of petroleum are shipped every year from Tampico.

Towns.—The towns are, as we should expect, either sea-ports on the coastal plain or mining centres on the table-land. **Mexico City**, the capital, is much the largest. It is connected by rail with the United States and with ports on the Pacific and Gulf coasts. **Vera Cruz** and **Tampico** are the chief Mexican seaports with artificial harbours on the shallow Gulf coast. A line of railway runs across the narrow peninsula of Tehuantepec with a port at either end. Vera Cruz has most of the foreign trade. The chief exports are silver, petroleum from the mines, mahogany and dye-woods from the forests, vanilla, coffee and tobacco from the plantations, hides from the pastures.

The Government is a republic. The whole of the New World south of the United States was at one time under the rule of Spain and Portugal. The language, laws, customs and religion are those introduced by the early settlers and soldiers and missionaries of these two countries. Very many of the place-names are Spanish words.

THE STATES OF THE ISTHMUS.*

Map Study : Relief.—Central America, as the map shows, consists of a long isthmus, thicker in the north and narrower in the south where, at the isthmus of Panama, it is only a little more than thirty miles broad. Central America is full of mountains—the highest ranges being in the broader part of the isthmus. A long and lofty range of volcanic peaks, many of them active, runs along the Pacific coast. The soft ashes vomited out by them have in some places filled up the valleys and in others have been swept down by the rivers to the coastal plains. This has made these districts very fertile. But near volcanoes earthquakes are common, and whole towns have been destroyed by them from time to time.

Climate and Productions.—We can form a good idea of this region if we imagine it as ten Ceylons placed end to end. The position, relief, climate and productions of the isthmus are much the same as those of that island (except that there are no volcanoes in Ceylon). The rivers are, naturally, short and they flow in deep gorges. The climate is hot and moist on the low-lying coasts but cooler and drier on the highest slopes. The isthmus is wetter on the Atlantic side facing the cloud-bearing winds. On the Pacific side the winds blow from the land and they are, therefore, dry. The coasts are fringed with lagoons, like those of Malabar, with coco-nut palms growing on their banks. Inland from them stretch dense jungles and, where these have been cleared, we find fields of rice and sugar-cane, plantain and cacao plantations. As we climb the slopes inland, we pass through dense forests, fed by the heavy rains, full of palms, rubber-trees, mahogany and dye-wood. In the interior, out of reach of the heavy rain winds, the climate is drier and we come to pasture lands. Here, on the fertile volcanic soil, coffee plantations are seen and maize and beans are the chief crops. It is very much as if we travelled inland from the Konkan coast.

People and Towns.—The population is scanty. The people are mostly Central American Indians, Spaniards and half-

* See also coloured map of North America.

breeds and, as most of them are uneducated, there are no manufactures. Most of the six independent republics have short railways joining seaports to inland towns. The chief towns of Nicaragua are round its lakes. These lakes lie in a hollow and it was at one time proposed to dig a waterway for ocean-steamers across the isthmus here. The route is longer than that taken by the Panama Canal, but these lakes

FIG. 189.—Locks on the Panama Canal. (By courtesy of the R.M.S.P. Co.)
(A vessel can now do in six hours what formerly took six weeks.

could have been used. On the other hand, the canal would have had to pass through a belt of active volcanoes and the earthquakes would have been sure to destroy it. So the engineers chose the more difficult but safer route. The most important state is Panama, on account of the great ship canal which now joins the two most important oceans of the world. This canal is about fifty miles in length - only about half as long as the Suez Canal. It is not, however, dug across a flat sandy isthmus but over rocky and unlevel ground, so

that vessels must pass through locks, the highest of which is eighty-five feet above sea-level. As yet only about ten vessels pass through it every week as compared with one hundred using the Suez Canal. Its traffic is bound to increase as it shortens the voyage between most of the ports on the Pacific and Atlantic coasts of both the American Continents. Kingston, in Jamaica Island, is the nearest British port.

British Honduras, a small colony stretches along part of the coast of Honduras Bay. Its chief port is **Belize**. It ships plantains and coco-nuts from the coast and mahogany and logwood felled in the upland forests and floated down the rivers in the rainy season. Mahogany is very suitable for making furniture. It is as hard as teak, but it is more beautiful and takes a high polish. From logwood dyes are made.

Central America is a good example of the forces which have shaped the surface of our earth, and about which we learned in an early chapter of this book. It is now part of a great continent, but, ages ago, it was not solid land but a group of islands separated by straits and channels joining the Atlantic Ocean with the Pacific. These islands were gradually raised, partly by earth-movements from below, partly by streams of lava from volcanoes and partly by alluvial deposits. In this way the two continents of North and South America were joined together by a broad isthmus.

THE ISLANDS OF THE WEST INDIES.

Map Study: Position and Size.—The map shows these islands, of which the largest are Cuba, Haiti and Jamaica, stretch into the Atlantic like a great bow or breakwater enclosing the Caribbean Sea. They form a kind of chain or broken bridge joining North, Central and South America. They differ in size and formation. Cuba is larger than Ceylon but most are quite small. Their total area is about the same as that of the Central Provinces. Some are the tops of sunken ranges of mountains which have been upheaved from the sea by volcanic forces (there are some


ATLANTIC OCEAN
GULF OF MEXICO
CARIBBEAN SEA
PACIFIC OCEAN
Tropic of Cancer
Florida
Havana
Bahama Is. (British)
Turks Is. (Br.)
CUBA
Jamaica
Kingston
Haiti
SANTO DOMINGO
Porto Rico (U.S.A.)
Virgin Is. (Br.)
Sombrero (Br.)
Anguilla (Br.)
St. Kitts (Br.)
Nevis (Br.)
Barbuda (Br.)
Antigua (Br.)
Montserrat (Br.)
Leeward Is.
Dominica (Br.)
St. Lucia (Br.)
Barbados (Br.)
St. Vincent (Br.)
Grenada (Br.)
Tobago (Br.)
Port of Spain
Trinidad (Br.)
Windward Is.
Greater Antilles
Lesser Antilles
MEXICO
BRITISH HONDURAS
Belize
GUATEMALA
HONDURAS
SALVADOR
NICARAGUA
COSTA RICA
PANAMA
Panama Canal
CENTRAL AMERICA
COLOMBIA
VENEZUELA
Orinoco R.
Georgetown
BRITISH GUIANA
DUTCH GUIANA
BRAZIL
SOUTH AMERICA
English Miles
0 50 100 200 300 400 500
Land above 3000 feet
Sea level to 3000 feet
Br. = British

volcanoes still active), while others have been built up from the lime in the sea by the coral polyps.

Climate.—All these islands lie inside or just outside the Tropics. Their climate is therefore much the same as that of Ceylon and so is their vegetation. Being islands, they receive plenty of rain. It comes chiefly from the Atlantic. But they are often visited by hurricanes (a West Indian word meaning stormy winds) which sweep over them and usually turn north-eastwards along the Atlantic coast of North America. They destroy crops, uproot trees, blow down buildings and wreck ships.

Vegetation.—The hot sun, good rainfall and volcanic soil make these islands very fertile. The plants are very like those of Ceylon or the wet Malabar coast. On the low-lying shores there are thick groves of coco-nut palms. Forests of mahogany and other good timber trees cover the hills inland. The hot, damp climate especially suits the growth of cane and tobacco. For hundreds of years these islands have supplied sugar and tobacco to Europe. **Havana,** the chief town of Cuba, makes the finest cigars in the world. The cacao tree grows well on the damp lower slopes just as it does in Ceylon, and there are coffee plantations on the hills. These islands also export to Europe and the United States large quantities of plantains, oranges and pineapples in ships specially fitted to keep them fresh during the voyage.

West Indian Islands which belong to the Empire.—The largest of these is **Jamaica** and a good map shows the others are the **Bermudas**, the **Bahamas**, **The Leeward Group** (Antigua, St. Kitts, Dominica and others), **The Windward Group** (Granada, St. Vincent) and **Trinidad**. Jamaica is a small Ceylon. From its harbour of Kingston plantains, coco-nuts, sugar, molasses, rum, coffee and cocoa are exported. In exchange it imports cotton, linen and woollen cloth, tools and machinery, flour and rice. The other islands have very much the same kind of trade. In the British island of Trinidad, off the coast of South America, is a wonderful lake of pitch. A man can walk on the surface without falling

through it. This pitch is exported in blocks to Europe. To what uses is it put? There are also oil wells on the island.

Cuba formerly belonged to Spain. It is now an independent republic. **Haiti** is divided into two negro republics. **Porto Rico** is under the control of the United States.

The People.—Since the discovery of the islands by Columbus the original inhabitants have almost disappeared. They were cruelly treated by their Spanish conquerors. For many years before the slave trade was abolished ship-loads of negro slaves from Africa were brought to work on the sugar and tobacco plantations. There is now a large population of half Spanish, half African blood. A good many Indians have emigrated to Jamaica and Trinidad to work on the sugar estates and to set up as traders in the villages.

CHAPTER LXXVI.

SOUTH AMERICA.

Map Study: Outline and Position.—The coast line of this continent is easy to draw and to remember. It is like a huge right-angled triangle, with the Pacific coast for its base and the North and South Atlantic washing its two sides. The narrow curved isthmus of Panama joins it to Central America. There are no long and wide inlets of the sea such as break up the shores of Europe and North America. Its southern Pacific coast, long ages ago, sank beneath the sea, and is broken up into a large number of small islands, the largest of which is Tierra del Fuego or 'the land of fire.' The long, narrow, winding strait of Magellan, between it and the mainland is called after a brave Portuguese voyager who was the first to sail through it. On the other hand, South America is different from Africa, its sister continent, in this, that its great rivers are splendid waterways from the coast far into the interior. A map of the world shows it stretches much farther south than Africa or Australia, and its Pacific coast, as a whole, lies farther east than the Atlantic coast of North America.

Build.—We can most easily remember this by contrasting it with that of India. In India a long and lofty barrier of mountain ranges lies to the north; a table-land fills up the peninsula in the south; and, separating them, is a broad alluvial plain watered by the Indus, Ganges and Brahmaputra. In South America, the Andes—the longest barrier of mountains in the world—stretches along the whole length of the continent in the west; a table-land, much larger and higher than the Deccan,

fills up its Eastern shoulder in the east, and between them there stretches a wide alluvial plain watered by the Orinoco, the Amazon and the Paraguay.

(a) **The Western High Land.**—Just like the Himalayas, the Andes are not everywhere a single chain. Opposite the bend in the west coast (about 20° S.) the Andes are about 400 miles broad. Between the ranges are high table-lands where we see

FIG. 191.—Cotopaxi. (By courtesy of the R.M.S.P. Co.)

two large lakes. In the north the ranges separate with wide valleys between. South of this bend the ranges come close together again, and finally the Andes run to the southmost point in a single range. Where the Andes are broadest they are also highest, some of the peaks being equal in height to all but the highest of the Himalayas. Unlike them, however, they are of volcanic formation. Near the equator are two lofty volcanoes, Cotopaxi and Chimborazo. The former is still active, but the latter is dead and has ice-fields round its crater. In the southern half rises a dead volcano, Aconcagua, the highest peak in the New World.

In the far south the coastal range has sunk. Its hills now form a fringe of islands, and its valleys inlets of the sea. The Andes are very difficult to cross. Even near the equator their highest peaks are covered with snow and glaciers. We must not think of them as made up only of steep mountains and deep valleys. Like the Rocky Mountains, they contain high and broad table-lands between the ranges.

(b) **The Eastern High Lands.**—These are divided into two parts by the broad valley of the Amazon. The high lands of Guiana are in the north-east: the high lands of Brazil fill up the huge, blunt angle of the continent nearly as far south as the Plate estuary. If we draw a line from the Amazon mouth to the Plate estuary, the Brazil high land lies east of this line. If we draw another line from the Amazon mouth to the isthmus of Panama, the Guiana high land lies to the north of it. The eastern high lands are not nearly so high as the Andes. They are really table-lands covered with forests.

(c) **The Central Plain.**—The rest of the continent is a vast plain drained by three large rivers and their feeders into the Atlantic—the Orinoco, the Amazon and the Paraguay-Parana. This Central Plain is so low that the basins of these rivers are only divided by swamps and the tributaries of the one rise close to those of another. **The Orinoco** drains the northern and western slopes of the Guiana high land, but also receives long feeders from the Andes. The river is navigable for boats right up to their base. The vast basin of **the Amazon** receives feeders from the Andes and both parts of the eastern high land. The head waters are formed by two rivers which flow northwards along steep valleys of the Andes over rapids and waterfalls, and join each other on the plain. From this meeting-place right across the continent to the sea, a distance much greater than the whole length of India, the Amazon is navigable for vessels which can float in twenty feet of water. But that is only the main river. The map shows it receives many feeders on both banks, most of which are also navigable by small steamers. Large ocean steamers can come up to the

river-port of Manaos on the Rio Negro just before its junction with the Amazon. This shows what an immense river the Amazon is. The Madeira is even a longer tributary. At least eight other feeders are as large as the Ganges at Patna. For the last 250 miles of its course the Amazon is nowhere less than 50 miles wide. In the rainy season the whole country on both banks is flooded for miles. The main river pours such a flood into the Atlantic that the sea is made muddy for hundreds of miles. Even 200 miles from its mouth a bucket may be dipped into the sea and bring up fresh water. **The Paraguay** river flows almost due south over the southern half of the Central Plain, receiving long feeders from the Andes on its right and from the Brazil high land on its left. Of the latter, the **Parana** is much the largest. The two rivers join more than half way down the plain, and the combined river is called the Paraguay-Parana to its mouth in the Plate estuary. The **Uruguay** also flows southwards into this estuary. The main river and many of its tributaries are navigable. River steamers can go for a thousand miles up from the mouth or for a distance equal to that between Calcutta and Bombay or Madras. Asuncion, a river port 970 miles up the river, is only 250 feet above sea-level. This shows how very flat the Central Plain is. It is really the floor of an ancient sea.

Three other rivers, not on the Central Plain, should be traced on the map. The **Sao Francisco,** which is as long as the Indus, rises in the highest part of the Brazilian high land, and flows north and east into the Atlantic. It is much longer than the Ganges, and is navigable for nearly 200 miles up from the sea. The **Tocantins,** rising in the same high land and flowing into the Amazon estuary, is even longer. The **Magdalena** flows northwards through a long valley of the Andes into the Caribbean Sea. South of the Plate a number of rivers flow across the flat plain from the Andes to the sea. These are only a few of the rivers. A detailed map shows hundreds of others. From this we can be sure that the continent receives a heavy rainfall. It comes from the Atlantic and the rivers carry it back into that ocean.

Climate.—All the broad part of the continent lies in the Tropics. Here, therefore, there is plenty of heat at all seasons

FIG. 192.

except on the highest mountains. The narrow southerly end which projects far south is much cooler. But on no part of the continent, except on the mountains, is it cold enough

to freeze water. The most important feature of the climate is the rainfall. A map of rainfall shows that an enormous quantity of water is carried by the north-east and south-east trade winds from the Atlantic, and poured over large parts of South America. In our cold season, when the heat belt is south of the equator, the basins of all the large rivers receive heavy rain. In our hot season all the parts north of the Amazon, and on the south-east coast north of the Plate are the wettest. The heaviest rainfall is in the Amazon valley where every month is wet. This explains why the Amazon is such a large river with so many tributaries. None of this moisture crosses the Andes: it is all sent back by rivers to the Atlantic, just as in India the Himalayas send back the rain of the monsoon by rivers to the Indian Ocean. On the western side of the Andes south of the equator the winds (the south-east trades) blow not towards the shore but away from it, so that almost no rain falls on that part of the coast. Far south it is different. Here the continent stretches south far enough to be in the track of the westerly winds. The Andes, however, prevent these westerlies from blowing rain clouds over them to the east coast. The east coast south of the Plate estuary is therefore dry. Much of it is a stony desert. But, on the whole, South America receives plenty of rain. The only dry parts are a narrow strip along the middle part of the western coast (the coasts of Peru and Northern Chile are drier than Sind), the table-lands of the middle Andes, and a part of the east coast stretching north from Tierra del Fuego.

The Vegetation of South America is like that of Africa. The vast forests of the Amazon basin on both sides of the equator match those of the Congo. Here great heat and a heavy rainfall produce vast tropical forests. They are the largest in the world: in area they are almost as large as India. Just as in the African forests, creepers climb from tree to tree upwards to the light. The forest is so dense that it is almost impossible to penetrate. The only way is to travel through it by boats on the Amazon and its numberless feeders.

Large parts of it are unexplored. Only a few tribes live in it. These forests were called Selvas by the Spanish invaders.

FIG. 193.—Natural Vegetation.

North and south of the very wet forest belt rain does not fall all the year round, and here we find wide stretches of grass land. The Spaniards gave them Spanish names. In the basin

of the Orinoco they are called llanos. South of the Amazon as far as the Plate estuary they are known as campos and as pampas inland from that estuary. The llanos and campos are savannah lands with forests here and there, especially on the damp banks of rivers. But the pampas in the south, where less rain falls, are almost treeless like the prairies of Canada and the veldt of South Africa. Large parts of the pampas have been ploughed up to grow wheat, lucerne and linseed.

Animals.—The forests are full of animal life. Troops of small monkeys live among the trees. Unlike the monkeys of India they have no cheek pouches in which they carry food and many kinds have long tails with which they can grasp branches. Do you know how a troop of these monkeys can cross a river? Huge snakes crawl about and hang from the trees. In the rivers are numberless fish and crocodiles. The tapir, an animal like a pig with a short trunk, wallows on the river-banks. Here the jaguar or South American leopard lurks for his prey. The Amazon and its feeders teem with all kinds of animal life. In the grass-lands deer and other grazing animals abound. The rhea, or South American ostrich, roams over the pampas. On the Andes live the llama, alpaca and vicuna, half camel half goat, and their thick coats yield a fine woolly hair. The llama is used in the high passes of the Andes as the yak is used in the Himalayas. The condor, which breeds in the highest peaks of the Andes, is the largest of the vulture family. There are two animals which perhaps we might be glad to introduce into India for they live on ants, especially white ants. One is the great ant-eater, about four feet long with a bushy tail. Instead of teeth it has a long sticky tongue with which it picks up insects. The other is the armadillo, and is so-called because it is covered with a kind of bony armour. When attacked it curls up into a ball like a porcupine. The settlers from Europe brought with them many useful domestic animals. On the pampas large numbers of cattle, horses and sheep are bred.

People.—The original inhabitants of South America are of the same race as the 'Indians' of North America. The Spanish

80°
60°
50°
40°
30°
10°
0°
Jamaica
Haiti
Porto Rico
West Indies
CARIBBEAN SEA
CENTRAL AMERICA
Barbados
ATLANTIC
OCEAN
Isthmus of Panama
Colon
Panama & Canal
Maracaibo
La Guayra
Caracas
Trinidad
R. Orinoco
Bolivar
Georgetown
BRITISH GUIANA
DUTCH GUIANA
FRENCH GUIANA
Highlands
Guiana
Bogota
COLOMBIA
Quito
Cotopaxi
Guayaquil
ECUADOR
Equator
R. Para
Para
Negro
R. Amazon
Manaos
R. Madeira
BRAZIL
Recife
R. San Francisco
Bahia
Callao
Lima
Sorata
PACI


Tropic of Capricorn
Antofagasta
Asuncion
PARAGUAY
Rio de Janeiro
Santos
ATLANTIC
OCEAN
Valparaiso
Santiago
Aconcagua
Rosario
R. Parana
R. Uruguay
URUGUAY
Buenos Aires
Monte Video
R. Plate
CHILE
OCEAN
ARGENTINA
PATAGONIA
Strait of Magellan
Falkland Is.
Port Stanley
Tierra del Fuego
C. Horn
SOUTH AMERICA
English Miles
0
500
1000
Principal Railways
30°
40°
50°
100°
90°
80°
70°
Long. West 60° of Greenwich 50°
40°
30°
20°
Emery Walker Ltd. sc

FIG. 194.

and Portuguese invaders and settlers brought with them their language and religion. Almost all the towns have Spanish or Portuguese names. Many married 'Indians' and there is now a large mixed population. The countries of Southern Europe have, in recent years, sent many emigrants into the pasture and agricultural lands lying inland from the Plate.

When we speak of Latin America, we mean the whole of South America, Mexico and Central America, for there Spanish and Portuguese are the official languages and they are derived from Latin.

Political Divisions.—Except British, French and Dutch Guiana and Brazil, all South America once belonged to Spain. The Spanish rule has disappeared and all the provinces are now independent republican states. Brazil for long belonged to Portugal. It, too, is now an independent republic, but Portuguese is still the language spoken. On the map trace the boundaries of Brazil. This large country takes up about half of the continent and touches all the other countries except two—Ecuador and Chile. Their names can be read from the map. Only two countries have no sea-coast.

British Guiana.—This is the only part of the continent which belongs to the Empire. It is a small colony south of the Orinoco, with a very low, flat and unhealthy coast. The most important crop is sugar, but the hot damp climate also suits cacao, tobacco, cotton and rice. The capital is **George-town.** Many Indians have emigrated to British Guiana. French and Dutch Guiana have the same products. Off the south-east coast the **Falkland group of islands** is also ruled by Great Britain. The climate is cold and wet. Sheep-rearing is the chief industry. Off these islands in the Great War a German fleet was destroyed by a British fleet.

A voyage along the coasts of South America.—The chief countries and towns.—Instead of studying each country in detail we can understand them better by taking a voyage round the continent and going inland here and there by rail or river. We begin by sailing from Georgetown along the low coast to the delta of the Orinoco. This great river flows through

the low-lying grass-land of **Venezuela**. It is much longer and deeper than the Ganges, and a steamer can take us up country for 700 miles. We pass through wide grassy plains where large herds of cattle are grazed. Their hides are exported to Europe. Returning to the low flat coast we sail round to **La Guayra**, the chief port of Venezuela. The hot plains produce cotton, tobacco and sugar, but the chief trade of the place is cocoa, for here the finest cacao trees are grown. To reach **Caracas**, the capital, only six miles inland, we have to take a long journey by train, for the line climbs over a spur of the Andes, through deep cuttings, along steep slopes and by tunnels under cliffs. Leaving La Guayra we pass the almost land-locked inlet of Lake Maracaibo, and reach the coasts of **Colombia** a country called after the great discoverer. Here we find the usual tropical crops of sugar cane, tobacco, cocoa, and cotton which thrive on the hot damp low-lands, and coffee on the cooler mountain slopes. We might sail for seven days up the Magdalena in a river steamer to a river-port from which, on mule back, we can reach the capital, **Bogota.** It stands on a table-land, twice as high as the Deccan, at the foot of the Andes. The houses are only one storey high for earthquakes often occur.

Returning to the coast and sailing south-westwards, we find our way blocked by the narrow and hilly isthmus of Panama. We can cross this by rail from a seaport on the Caribbean Sea—a journey of only fifty miles—to another on the Pacific. We can now also sail through the Panama Canal in a few hours, and reach Panama harbour and steam out into the open Pacific. From this port a three days' voyage southward along the coast brings us to the seaport of **Guayaquil** at the head of a small gulf. On our way we cross the equator and we see the slopes and the snowy peaks of the distant Andes.

We are now in **Ecuador**, which is the Spanish word for equator. To reach the capital, **Quito**, we have to climb 9000 ft. by railway or on mule-back. The mule is the only animal sure-footed enough to climb up the steep and winding mountain paths. On the way we pass through forests of palms and plantations

of plantains, india-rubber, cacao, oranges and coffee. As we rise higher it becomes too cold for forests, and we reach slopes of coarse grass where sheep are pastured. We meet troops of llamas carrying coffee and cacao down to the coast. Quito

FIG. 195.—A high Valley among the Andes.

is one of the highest cities in the world. It stands on a table-land, and all round it rise giant peaks covered with snow. Though it is on the equator, its great height gives it a cool climate all the year round.

Descending to the sea again, we continue our voyage along the coast of **Peru**, which has a sea-board as long as that of India from Karachi to Cape Comorin. Just like Ecuador, Peru is nearly filled with parallel ranges of the Andes between which lie table-lands and valleys. Beyond these ranges are the long north and south valleys down which the three rivers that are the head waters of the Amazon rush before they turn eastwards along the Central Plain of the continent. We quickly see we have reached the dry part of the Pacific coast. Scarcely a plant or tree can be seen, and many parts are as barren as the Sahara, and quite different from the damp, forested slopes and valleys on the other side of the mountains. The south-east trade wind blowing from the Atlantic pours heavy rain on the Central Plain, and the eastern face of the Andes. When it passes the snow-capped ranges of these mountains, the last drop of water has been wrung from it, just as happens with the monsoon winds when they try to cross the Himalayas. The wind then rushes down the Pacific slopes as a dry wind. In some parts of the coast no rain falls for twenty years at a time. But the coast is not all a desert. Cultivation can be carried on by irrigation fed by the short streams which flow down from the melted snows of the mountains. Here sugar-cane, rice, cotton, plantains, grapes and tobacco are grown. The inland slopes produce cocoa and coffee. The western slopes of the Andes are here almost rainless, but the damp mists allow the grass to grow which feeds herds of cattle and sheep. Alpacas and vicunas are also bred which produce fine silky wool.

Three days' voyage from Guayaquil lands us in **Callao**, a fine harbour, and a short railway journey across the dry coast plain brings us to the capital **Lima**. A boy in Lima may be old enough to go to school before he sees his first shower of rain. The people get all their water from streams flowing from the distant mountains. These mountains contain most of the known minerals—especially silver. To reach them we take train from Lima up the Andes once more and reach

Pasco.* It was the silver mines that attracted the Spanish conquerors to Peru. They are said to have found here so much silver that they shod their horses with it. We could also visit the interior of Peru by landing at **Mollendo**, a port 500 miles south of Callao, from which we can climb the Andes by another mountain railway. We must remember Peru is unlike most other countries. Its low-lying coast strip is desert.

FIG. 196.—A Railway up the Slopes of the Andes in Peru.

Only in the mountain valleys can many people live, and it is absolutely necessary to join these more fertile parts to the coast by roads and railways. It is very difficult, but it must be done. The line from Mollendo is one of the most wonderful in the world. It had to be built by zig-zag paths along narrow ledges of rock, through many tunnels and on bridges across wide gorges up to the inland table-land. On we go over this table-land (much higher than the Deccan), far above the clouds, till we reach **Lake Titicaca**, the largest

* This is the highest railway in the world—one point of it is more than twice as high as Ootacamund station.

in South America. All around are the lofty snow-capped peaks.

A steamer can take us across this lake, and we enter the country of **Bolivia.** It has no sea-coast, but occupies the broadest part of the table-land of the Andes, and, to the east, a part of the Central Plain drained by the rivers which feed the Madeira, one of the largest tributaries of the Amazon. Not far from the south end of the lake is **La Paz** its largest city. The Spaniards called this country 'the Land of Gold.' There are still mines of gold, copper, silver and tin, but they are difficult to work. From La Paz we need not return by the way we came from the coast. A shorter and very steep line takes us to the harbour of Arica. Another railway running south along the central table-land, and then across the outer range of the Andes, takes us to **Antofagasta**, a seaport of Chile. On the way we should pass close to the silver mines of Potosi—the most famous in the world. They were discovered 300 years ago, and enough silver has been dug from them to give every man, woman and child in the world a solid silver bangle.

'We are now in **Chile**, one of the best governed republics in South America. It consists of a long narrow strip of coast—nearly twice as long as the Arabian Sea coast of India—stretching right down the southern half of the continent. Thus the warm northern half will be quite a different country from the cold coasts of the south. At Antofagasta we are in the midst of a hopeless desert for we are still in the rainless part of the Pacific coast. This desert of Atacama stretches along the coast and inland for hundreds of miles northwards to Peru and eastwards into Argentina. But the harbour of Antofagasta is full of ships, for from it is exported much mineral wealth. Not only does it export copper and other metals, but in the desert are found rich deposits of a kind of saltpetre which is exported in ship-loads to Europe where it is largely used as manure. This is a proof that this part of Chile is very dry, for, if much rain fell, it would wash these deposits away. Three days' voyage southwards brings us to

Valparaiso, which has the finest harbour on the Pacific coast of this continent. We are no longer in the barren part of northern Chile. Valparaiso in Spanish means 'the valley of Paradise.' We are now far enough south to receive the wet westerly winds from the Pacific. Chile is unlike any other country in the world. It consists of a very long valley lying between the Andes and a low range of coast hills. In the wet part of this valley many short rivers find their way to the sea. In the south the valley has sunk into the sea so that hundreds of inlets and islands are formed. In the middle and wet part of this valley the climate suits the growth of wheat, maize, tobacco and fruit. In the south and on the islands are fine forests fed by the rain brought by the west winds. We could now continue our voyage down the coast past the islands and among the inlets and round by Cape Horn island in the extreme south. As we sailed south, we should find the weather getting colder and more stormy. Here the coast is almost uninhabited, and there are no harbours. To escape the storms of Cape Horn, we might sail for 400 miles through the Strait of Magellan which is an important waterway for steamers. The land on both sides is very mountainous, and the peaks are covered with snow. Fogs often occur. Only a few savages live on the barren rocky shores.

Instead of coasting round by the cold rocky shores of southern Chile, let us take a short cut across the continent. A railway now joins Valparaiso with the Atlantic seaport of Buenos Aires—a distance as far as from Bombay to Madras. A six hours' journey takes us inland to **Santiago,** the capital of Chile, a large modern city like Valparaiso. Then we climb the Andes once more and cross them by a tunnel under a pass 10,000 ft. above sea-level close to Mt. Aconcagua.

We are now in **Argentina**. We have left the narrow coast-land and steep rugged mountains of the west behind and have entered the wide-spreading Central Plain. At first we pass through steppe and desert land fit only for pasture, because the west winds cannot carry rain over the Andes. But, as we travel east, more rain falls and the soil is more

fertile. Rich grass lands and cultivated fields where the pampas have been ploughed are seen for miles and miles as far as the eye can reach. **Argentina, Uruguay** and **Paraguay,** the countries which take up the part of the Central Plain watered by the rivers flowing into the Plate estuary, are the richest agricultural parts of South America. Here great herds of cattle are pastured on the grass-lands as well as thousands of sheep and horses. Plenty of rain falls; there are many rivers and the soil is fertile, so that large crops of wheat, maize and linseed are reaped. A good map shows what an advantage these countries have over those on the Pacific coast. Here the land is nearly level, the rivers are long and navigable, and railways can easily be made. The basin of the main river and the low-land inland north, west and south of Buenos Aires are crossed by a network of railway lines. There are more of them here than all the rest of the railways of South America. On the Pacific coast, on the other hand, only a few have been built, and that at great cost, leading from the seaports up the slopes and valleys of the Andes.

These railways and the navigable rivers have helped the farmers to send their cattle and crops to the seaports. Ships loaded with wool, hides, mutton, beef and tallow are constantly leaving Buenos Aires and other harbours for Europe. Argentina is one of the chief suppliers of wheat, maize and linseed to European countries. **Rosario,** nearly 200 miles up the Părana, can take in ocean steamers. This shows how much larger this river is than the Ganges. **Asuncion,** the chief town of Paraguay, though nearly 1000 miles from the sea is another important river-port. The two chief ports are **Buenos Aires** and **Monte Video** on either side of the Plate estuary. Buenos Aires, the capital of Argentina, is the most important city and seaport in South America, with as large a population as Bombay. We might call it the Calcutta of South America. Behind it lies one of the largest and most productive plains of the world, and inland trade comes to it from all directions by river and rail. The climate of the country is cool enough for Europeans, and many settlers,

especially from Italy, have crossed the Atlantic to make this land their home. On the Uruguay river are two towns, **Fray Bentos** and **Paysandu,** where beef-juice and beef are prepared and sent abroad in tins. To make this beef 1500 head of cattle are slaughtered every day for six months in the year. The breeders of the cattle sometimes pay as much as half a lakh of rupees for a bull from England. Monte Video exports large quantities of cattle products.

The last country we visit is the largest—**Brazil.** It takes up about half the continent, and is about twice the size of India. The greater part of Brazil consists of the low, flat, Amazon basin. Here forest tribes collect rubber and nuts and take them down the rivers to Manaos and other river-ports to meet the steamers from the coast which sail up to fetch them. The Brazilian high land, which fills up the projecting shoulder of the continent, is a vast table-land crossed by ranges of mountains. This table-land is higher and, of course, very much larger than the Deccan, but like the Deccan it has been worn down by rivers flowing in all directions and forming deep and long valleys. In this table-land the heat is not so great as in the low-lying Central Plain, and there is much more tillage. Maize, cotton, sugar and tobacco are grown, and cattle and sheep are grazed for their hides and skins and wool. The most important parts of Brazil are, however, the southern districts where the climate is much cooler. On the high land near the coast much coffee is grown, and Brazil produces about three-quarters of all the coffee in the world. It is exported from Santos and Rio de Janeiro, two seaports on this coast. All the chief towns of Brazil are either seaports or river-ports. The interior is thinly peopled and but little explored. The largest vessels can reach **Manaos**, a rubber port far up the Amazon. But the chief market and port of the Amazon rubber trade is **Para**, on one of its mouths. **Recife** or **Pernambuco, Bahia, Rio de Janeiro** and **Santos** are other seaports. The largest of these is Rio de Janeiro, the capital of Brazil, with a population nearly as large as Calcutta. It is built on a fine sheltered bay surrounded by

FIG. 197.—Santos Harbour, Brazil.—Steamers waiting for Cargoes of Coffee.
(By courtesy of the Royal Mail Steamship Company.)

mountains, and trades across the Atlantic with all parts of the world. From these ports railways run a short way inland.

We have now visited most parts of South America and learned what a rich and fertile continent it is. But, in spite of its fertility, it is very backward. Large parts of the interior are still unknown. With the exception of the European settlers the people are but little educated. In spite of its fertility too, South America has few inhabitants for its size. They number less than the population of Bengal and only about twice that of Bombay Presidency. The exports are chiefly those of the forests, mountains, pastures and mines—wheat, linseed, maize, meat, hides and wool from ports on the Plate estuary; nitrates and copper from north Chile ports; coffee from Santos and Rio; rubber from the Amazon; sugar from Georgetown, and cocoa from ports in the tropics. There are but few manufactures. Manufactured goods are almost all imported. Calcutta sends gunny bags. The only important towns are seaports or river-ports.

South America lies far off on the other side of the world from India. Sailing south of Cape Horn we would come in sight of the ice that surrounds the small continent round the South Pole. Here it is too cold for man to live, and only a few brave captains and sailors have reached its ice-blocked shores.

In this book we have studied the lands of our globe, and learned how the people in these lands work and live. Some lands are hot, some cool, and some covered with ice. Here we find deserts, there fertile plains; sometimes we have to climb steep and high mountains, or travel over barren table-lands or find our way through dense forests. The big rivers help us to visit the interior of some countries. Ships and steamers carry us across the great oceans and seas, along their coasts and through their straits. Almost every corner of the globe has man explored and now he can send messages, like whispers, as swift as lightning across the sky or under the sea

from one continent to another. How many are his inventions! The earth is his storehouse; the plains he has made his garden; the rocks his workshop, the mountains his fortress, the rivers his fountains, the ocean his pathway, and the stars his guide. From the huge elephant to the tiny silk-worm how many creatures do him service! Even the air obeys him, for has he not fashioned winged machines to bear him above the clouds across continents and oceans with the speed of the swiftest eagle?

But man never comes to the end of his lessons. He is always winning some new secret from the earth or air or fire or water. Geography is the story of how man makes use of the things and places he finds on the earth and, so, this story never comes to an end. But the more we study geography, the more fully do we understand how these mountains and plains, rivers and seas, deserts and forests are parts of one great world which is the Dwelling Place of Man.

A new way of learning Geography.
(This type ot airship is used to carry passengers between India and Europe.)

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Abbreviations are used in the index as follows:

C = Cape.	P. = pass.
Chars. = characteristics.	Pa. = peninsula.
Cl. = climate.	Pl = plain.
Div(s) = division(s).	R(s) = river(s).
Et seq. = and following pages.	Rlwy(s) = railway(s).
G = gulf.	Ra. = range.
Hs. = hills.	St. = state.
I(s) = island(s).	Str(s) = strait(s).
L. = lake.	Tn. = town.
Manu. = manufacturers.	Tr. = trade.
Mt(s) = mountain(s).	Vall. = valley.

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By ED. J. S. LAY, F.R.G.S.

With Illustrations and Maps.

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